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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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Cumulated (semiannual and annual) indexes: United States and possessions, $100; all other countries, $115.

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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Volume 11 Number 23 / December 8, 1973

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02 Aircraft **2740**
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

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Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences **2749**
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology **2750**
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry **2753**
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

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Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics **2768**
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

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13 Geophysics **2777**
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

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Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

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17 Materials, Metallic **2803**
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 2806
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 2812
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2813
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2816
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2818
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28 Propulsion Systems 2828
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29 Space Radiation 2833
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31 Space Vehicles 2847
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

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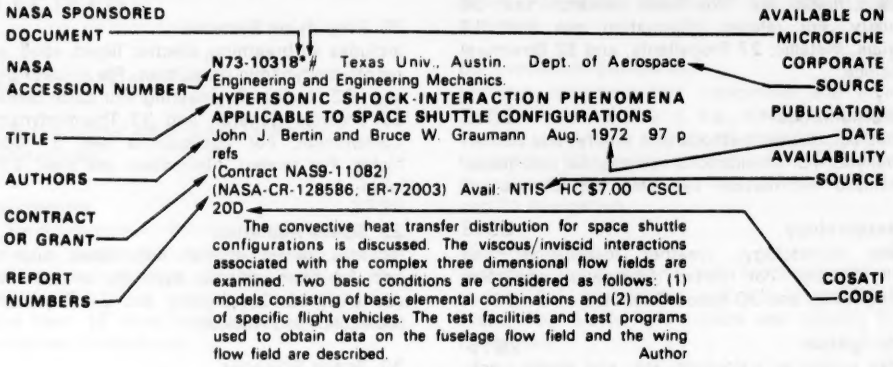
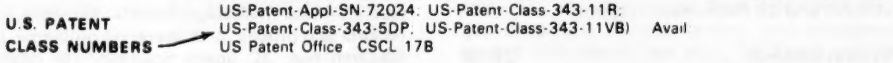


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586, ER-72003) Avail: NTIS HC $7.00 CSCL 20D

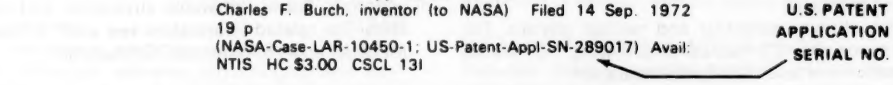
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



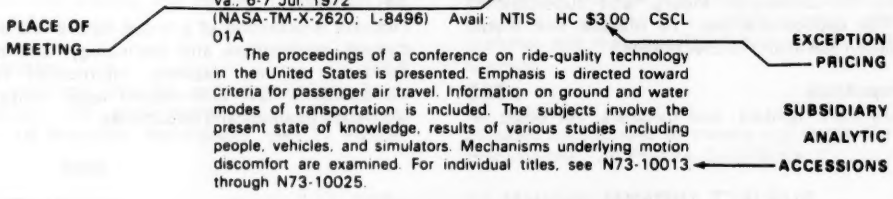
N73-12211* National Aeronautics and Space Administration Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620, L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 23 / DECEMBER 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-31925*+ National Aeronautics and Space Administration, Washington, D.C.

AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY, SUPPLEMENT 33

Jul. 1973 125 p refs

(NASA-SP-7037(33)) Avail: NTIS HC $4.25 CSCL 01A

This special bibliography lists 419 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1973. Author

N73-31926*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF BOUNDARY LAYERS IN AN AXISYMMETRIC, MACH 2.5, MIXED-COMPRESSION INLET

Warren R. Hingst and David F. Johnson Washington Oct. 1973 35 p refs

(NASA-TM-X-2902; E-7380) Avail: NTIS HC $3.00 CSCL 20D

An experimental investigation has been made of the boundary layer flow in a supersonic axisymmetric inlet. The inlet was designed for Mach 2.5 and had a 60 percent internal supersonic area contraction. Porous bleed regions were incorporated into both the cowl and centerbody for boundary-layer control. Five bleed configurations were studied; these included bleed regions upstream of, across, and downstream of the experimentally determined shock-impingement points. The tests were conducted at tunnel unit Reynolds numbers of 8.2 million and 2.7 million per meter. Static-pressure measurements were made along the internal inlet surfaces. In addition to locating the position of the shocks, these measurements also showed local regions of expansion resulting from the suction bleed. Boundary-layer profiles were measured with translating pitot pressure probes located on both sides of the shock-impingement points on the cowl and centerbody. These measurements showed that the boundary-layer profiles were distorted in the vicinity of the terminal shock. Author

N73-31927*# Aeronautical Research Inst. of Sweden, Stockholm.

RESEARCH ON THE SONIC BOOM PROBLEM. PART 1: SECOND-ORDER SOLUTIONS FOR THE FLOW FIELD AROUND SLENDER BODIES IN SUPERSONIC FLOW FOR SONIC BOOM ANALYSIS Final Report

M. Landahl and P. Loefgren Washington NASA Oct. 1973 66 p refs

(Grant NGR-52-120-001)

(NASA-CR-2339; FFA-AU-621-Pt-1) Avail: NTIS HC $3.50 CSCL 20D

A second-order theory for supersonic flow past slender bodies is presented. Through the introduction of characteristic coordinates as independent variables and the expansion procedure proposed by Lin and Oswatitsch, a uniformly valid solution is obtained for the whole flow field in the axisymmetric case and for far field in the general three-dimensional case. For distances far from the body the theory is an extension of Whitham's first-order solution and for the domain close to the body it is a modification of Van Dyke's second-order solution in the axisymmetric case. From the theory useful formulas relating flow deflections to the Whitham F-function are derived, which permits one to determine the sonic boom strength from wind tunnel measurements fairly close to the body. Author

N73-31928*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL INVESTIGATION OF A LARGE-SCALE, TWO-DIMENSIONAL, MIXED-COMPRESSION INLET SYSTEM: INTERNAL PERFORMANCE AND DRAG AT TRANSONIC CONDITIONS, FREE STREAM MACH EQUALS 0.6 TO 1.28

Norman D. Wong and Warren E. Anderson Washington Oct. 1973 47 p refs

(NASA-TN-D-7445; A-4775) Avail: NTIS HC $3.00 CSCL 20D

A large scale, variable-geometry inlet system with a design Mach number of 3.0 was tested at Mach numbers from 0.6 to 1.28. Variable features for off-design operation are an adjustable-height ramp system and a translating cowl. Experimental results are presented for transonic ramp and cowl positions showing the effect of throat boundary layer bleed and vortex generators on engine-face performance. Detailed pressure and force-balance data are used to evaluate transonic drag characteristics. Author

N73-31929*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INVESTIGATION, AT INLET LOCATIONS, OF FUSELAGE FLOW FIELDS AT TRANSONIC AND SUPERSONIC SPEEDS

Lyndell S. King Washington Aug. 1973 124 p refs

(NASA-TN-D-7364; A-4582) Avail: NTIS HC $4.25 CSCL 01C

Wind tunnel tests were conducted to determine the flow distribution about fuselage configurations at transonic and supersonic speeds and at angles of attack up to 20 degrees. The models tested were approximately one-twelfth scale and consisted of a main fuselage forebody member and several attachable components. The components were mounted in several combinations to represent different possible configurations for tactical aircraft. Flow distribution surveys were conducted at two inlet locations ahead of and under the wing to assess the effects of forebody geometry for the conditions indicated. The data indicate the influence of the canopy, nose droop, and fuselage shape on flow angularities in the forward survey plane. Author

N73-31930*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.

STUDY OF INDUCED LOAD AND STRESS, VOLUME 3 Final Report
L. L. Coons, J. M. Reddecliff, A. E. Wemmell, and W. E. Young Nov. 1972 134 p refs
(Contract NAS3-11216)
(NASA-CR-72712; PWA-FR-3704-Vol-3) Avail: NTIS HC $8.75 CSCL 20D

An analytical and experimental investigation into the effects of blade tip clearance on inducer performance and of leading edge sweepback on both blade pressure loading and performance was performed. Tip clearance flow was represented with a vortex flow model and measured data from previous inducer tests at three clearances were correlated with model predictions. A leading edge model was added to an existing inducer internal flow analysis, tests with two sweepbacks were conducted, and blade pressure and performance predictions were correlated with measured data. Author

N73-31931*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TUNNEL TESTS OF A 20 INCH DIAMETER 1.15 PRESSURE RATIO FAN ENGINE MODEL
H. L. Wesoky and F. W. Steffen 1973 32 p refs Presented at the 9th Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; cosponsored by AIAA and SAE
(NASA-TM-X-71445; E-7705) Avail: NTIS HC $3.75 CSCL 20D

Aerodynamic and acoustic measurements at a typical STOL aircraft takeoff and landing velocity demonstrated that a 1.35 inlet lip area contraction ratio was superior to a 1.26 ratio at high nacelle incidence angles. Reverse thrust, obtained with a variable pitch rotor, was lower at the landing velocity, and the noise level higher, than at the static condition. High speed tests showed that, for the design cruise Mach number of 0.75, internal losses and external drag were 27 percent of the ideal fan net thrust, and propulsive efficiency was estimated to be 59 percent for an 85 percent efficient fan stage. Author

N73-31932*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO-DIMENSIONAL ANALYTICAL AND EXPERIMENTAL PERFORMANCE COMPARISON FOR A COMPRESSOR STATOR SECTION WITH D-FACTOR OF 0.47
Nelson L. Sanger Washington Oct. 1973 41 p refs
(NASA-TN-D-7425; E-7280) Avail: NTIS HC $3.00 CSCL 20D

Analytically computed flow parameters were compared to measured values for the midspan double-circular-arc section of a stator in subsonic flow. Analytical procedures included calculations for inviscid flow, blade surface boundary layers, and loss coefficients. Comparisons were made at three incidence angles. Methods for prescribing the exit fluid angle in inviscid flow calculations were investigated. Measured loss coefficients were compared to calculated values. Two methods for predicting performance involving iterative use of ideal flow and boundary layer calculations were investigated. Author

N73-31933# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
SOME AERODYNAMIC CONSIDERATIONS OF THE FLIGHT CHARACTERISTICS OF TOWING SYSTEMS USING LONG TOWLINES AT HIGH SPEEDS
D. Pierce and L. J. Beecham London Aeron. Res. Council 1972 58 p refs Supersedes RAE-TM-AERO-1082; ARC-34018
(ARC-CP-1235; RAE-TM-AERO-1082; ARC-34018) Avail: NTIS HC $5.00; HMSO 95p; PHI $3.90

Wind tunnel experiments, at supersonic speeds, to determine the characteristics of the three-dimensional growth of turbulent boundary layers on long axi-symmetrically placed wires are described. The results have led to the development of a method for calculating the shape of tension, and drag distribution (skin friction) along long towlines as used in aircraft target towing systems. ESRO

N73-31934# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
IN-PLANE AND OUT OF PLANE STABILITY DERIVATIVES OF SLENDER CONES AT MACH 14
Otto Walchner and Frank M. Sawyer Jul. 1973 27 p refs (AF Proj. 7064)
(AD-765164; ARL-73-0090) Avail: NTIS CSCL 16/3

A 10-deg circular cone with various spherical and conical (45 degrees) nose bluntnesses of 1.7%, 10% and 25% was investigated in ARL's Mach-14 wind tunnel. Test results confirm that the static and dynamic stability coefficients are not equal in pitch and in yaw for nonzero angles of attack if the pitching moment becomes a nonlinear function of angle of attack due to nose blunting. The inequality of the in plane and out of plane stability derivatives was found at small angles of attack which are only fractions of the cone half angle. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-31935 Purdue Univ., Lafayette, Ind.
OPTIMAL MULTIPLE AIRCRAFT CONTROL FOR TERMINAL AREA APPROACH Ph.D. Thesis
David Kelso Schmidt 1972 176 p
Avail: Univ. Microfilms Order No. 73-15862

The specification of the curved approach paths and landing sequence for a group of aircraft desiring to land in a terminal area such that the terminal-area system performance is maximized was investigated. The multiple-aircraft problem includes the aspect of competition or cooperation between the vehicles by formulating the problem as a set of disconnected optimal trajectories. The flight paths are governed by kinematic equations of motion while in-flight and terminal-time separation inequality constraints between trajectories are imposed. The performance criterion for the system is the sum of the flight durations plus the integrated weighted accelerations of the aircraft. The solution approach employs penalty functions for the treatment of the inequality contraints and is based on the steepest descent algorithm. Dissert. Abstr.

N73-31936 Rhode Island Univ., Kingston.
AN ANALYSIS OF THE RELATIONSHIP BETWEEN THE PARACHUTE SYSTEM PARAMETERS AND THEIR EFFECT ON THE SYSTEM IN FLIGHT Ph.D. Thesis
Gregory C. DeSantis 1973 219 p
Avail: Univ. Microfilms Order No. 73-16332

The cause and effect relationships which exist among the parameters associated with a parachute-payload system during the deployment and trajectory are analyzed. A computer simulation model with the capability of providing a wide range of flexibility in predicting the characteristics of full-scale and model systems in flight was developed. Prior to the study, most research was concentrated on the analysis of individual areas of parachute technology such as parachute inflation, snatch force, parachute filling time and steady state trajectories. The simulation integrates the specific characteristics of the parachute-payload system, airdrop aircraft and drop zone into a conglomerate analysis which can be exercised as many times as needed to evaluate the various parameters. Dissert. Abstr.

N73-31937*# Boeing Vertol Co., Philadelphia, Pa.
NOISE REDUCTION OF A TILT-ROTOR AIRCRAFT INCLUDING EFFECTS ON WEIGHT AND PERFORMANCE
J. Gibs, W. Stepniewski, R. Spencer, and G. Kohler Jun. 1973 223 p refs Sponsored in part by Army Air Mobility R and D Lab., Ames Directorate
(Contract NAS2-6784)
(NASA-CR-114648; D222-10062-1) Avail: NTIS HC $13.25 CSCL 20A

Various methods for far-field noise reduction of a tilt-rotor acoustic signature and the performance and weight tradeoffs

which result from modification of the noise sources are considered in this report. In order to provide a realistic approach for the investigation, the Boeing tilt-rotor flight research aircraft (Model 222), was selected as the baseline. This aircraft has undergone considerable engineering development. Its rotor has been manufactured and tested in the Ames full-scale wind tunnel. The study reflects the current state-of-the-art of aircraft design for far-field acoustic signature reduction and is not based solely on an engineering feasibility aircraft. This report supplements a previous study investigating reduction of noise signature through the management of the terminal flight trajectory. Author

N73-31938# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
EJECTION CLEARANCES IN CANADIAN FORCES AIRCRAFT
P. W. Cressman May 1973 12 p refs
(DCIEM-936) Avail: NTIS HC $3.00

The knee clearance ejection envelopes are reported for all Canadian Forces aircraft presently in service. The effects of clothing, posture and restraint harness on ejection clearances are discussed in some detail. The maximum safe thigh length for each aircraft and the percentage of Canadian Forces pilots affected is presented for each aircraft. Author

N73-31939*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ANALYTICAL STUDY OF TAKEOFF AND LANDING PERFORMANCE FOR A JET STOL TRANSPORT CONFIGURATION WITH FULL-SPAN, EXTERNALLY BLOWN, TRIPLE-SLOTTED FLAPS
Harold P. Washington and John T. Gibbons Washington Oct. 1973 49 p refs
(NASA-TN-D-7441; H-709) Avail: NTIS HC $3.00 CSCL 01C

Takeoff and landing performance characteristics and field length requirements were determined analytically for a jet STOL transport configuration with full-span, externally blown, triple-slotted flaps. The configuration had a high wing, high T-tail, and four pod-mounted high-bypass-ratio turbofan engines located under and forward of the wing. One takeoff and three approach and landing flap settings were evaluated. The effects of wing loading, thrust-to-weight ratio, weight, ambient temperature, altitude on takeoff and landing field length requirements are discussed. Author

N73-31940*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF THE LONGITUDINAL CHARACTERISTICS OF A LARGE-SCALE VARIABLE WING-SWEEP FIGHTER MODEL IN THE HIGH-LIFT CONFIGURATION
William T. Eckert and Ralph L. Maki Aug. 1973 85 p Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62244) Avail: NTIS HC $6.75 CSCL 01C

The low-speed characteristics of a large-scale model of the U. S. Navy/Grumman F-14A aircraft were studied in tests conducted in the Ames Research Center 40- by 80-Foot Wind Tunnel. The primary purpose of the program was the determination of lift and stability levels and landing approach attitude of the aircraft in its high-lift configuration. Tests were conducted at wing angles of attack between minus 2 deg and 30 deg with zero yaw. Data were taken at Reynolds numbers ranging from 3.48 million to 9.64 million based on a wing mean aerodynamic chord of 7.36 ft. The model configuration was changed as required to show the effects of glove slat, wing slat leading-edge radius, cold flow ducting, flap deflection, direct lift control (spoilers), horizontal tail, speed brake, landing gear and missiles. Author

N73-31941*# Lockheed-California Co., Burbank.
STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT HAUL TRANSPORTATION
T. P. Higgins, E. G. Stout, and H. S. Sweet Washington NASA Jul. 1973 76 p refs Prepared in cooperation with Lockheed-Georgia Co., Marietta
(Contract NAS2-6995)
(NASA-CR-135481) Avail: NTIS HC $6.00 CSCL 01C

A study of quiet turbofan short takeoff aircraft for short haul air transportation was conducted. The objectives of the study were to: (1) define representative aircraft configurations, characteristics, and costs associated with their development, (2) identify critical technology and technology related problems to be resolved in successful introduction of representative short haul aircraft, (3) determine relationships between quiet short takeoff aircraft and the economic and social viability of short haul, and (4) identify high payoff technology areas. Author

N73-31942# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION, ISSUE NO. 5 OF 1972 ACCIDENTS
9 Jul. 1973 344 p
(NTSB-BA-73-7) Avail: NTIS HC $19.25

Aircraft accidents occurring in U.S. Civil Aviation during calendar year 1972 are reported. The reports concern 542 General Aviation and 13 U.S. Carrier accidents. The format presents the facts, conditions, circumstances, and probable cause for each accident. Author

N73-31943# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: JUGOSLOVENSKI AEROTRANSPORT (JAT) BOEING 707-321, YU-AGA, JOHN F. KENNEDY INTERNATIONAL AIRPORT, JAMAICA, NEW YORK, 13 AUGUST 1972
4 Apr. 1973 30 p
(NTSB-AAR-73-7) Avail: NTIS HC $3.50

An aircraft accident involving a Boeing 707 aircraft which ran off the runway following an aborted takeoff at John F. Kennedy Airport, New York, on 13 August 1972 is reported. The pilot elected to abort the takeoff when the right cockpit window came open during the takeoff run. The speed and weight of the aircraft made it impossible to stop within the distance remaining and the aircraft impacted a blast fence at the end of the runway. Author

N73-31944# Tennessee Univ. Space Inst., Tullahoma.
FUNDAMENTAL RESEARCH ON ADVANCED TECHNIQUES FOR SONIC SUPPRESSION Final Report
B. H. Goethert, Y. S. Pan, S. N. Chaudhuri, R. Kohl, H. Gruschka, and Philip Kessel Nov. 1972 209 p refs
(Contract DOT-FA70WA-2260)
(FAA-RD-73-4) Avail: NTIS HC $12.50 CSCL 20A

A multiphase theoretical investigation on predicting and alleviating sonic boom intensity is described. A new theory to predict sonic boom intensity on the ground from wind tunnel tests using normal size models (as opposed to the very small models presently used) was developed. A relatively easy method to determine aircraft contours with desirable finite pressure rise times is presented, as is a method to determine phantom body shapes with desirable pressure rise times which can be simulated by heat addition to the flow upstream of the aircraft. It is shown that a slotted nozzle engine exhaust has the unique capability to shift lift from the solid surface of the wing to the region behind the wing, with a resulting reduction in sonic boom intensity. Author

N73-31945*# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT NOISE SOURCE AND CONTOUR ESTIMATION
D. G. Dunn and N. A. Peart Jul. 1973 233 p refs
(Contract NAS2-6969)
(NASA-CR-114649; D6-60233) Avail: NTIS HC $13.75 CSCL 20A

Calculation procedures are presented for predicting the noise-time histories and noise contours (footprints) of five basic types of aircraft; turbojet, turofan, turboprop, V/STOL, and helicopter. The procedures have been computerized to facilitate prediction of the noise characteristics during takeoffs, flyovers, and/or landing operations. Author

N73-31946*# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT NOISE SOURCE AND COMPUTER PROGRAMS - USER'S GUIDE
K. C. Crowley, M. A. Jaeger, and D. F. Meldrum Jul. 1973 112 p refs

(Contract NAS2-6969)
(NASA-CR-114650; D6-60234) Avail: NTIS HC $7.75 CSCL 20A

The application of computer programs for predicting the noise-time histories and noise contours for five types of aircraft is reported. The aircraft considered are: (1) turbojet, (2) turbofan, (3) turboprop, (4) V/STOL, and (5) helicopter. Three principle considerations incorporated in the design of the noise prediction program are core effectiveness, limited input, and variable output reporting. Author

N73-31947*# Boeing Vertol Co., Philadelphia, Pa.
V/STOL TILT ROTOR AIRCRAFT STUDY MATHEMATICAL MODEL FOR A REAL TIME SIMULATION OF A TILT ROTOR AIRCRAFT (BOEING VERTOL MODEL 222), VOLUME 8
H. Rosenstein, M. A. McVeigh, and P. A. Mollenkof Apr. 1973 570 p refs
(Contract NAS2-6598)
(NASA-CR-114601; D222-10061-1-Vol-8) Avail: NTIS HC $30.50 CSCL 01C

A mathematical model for a real time simulation of a tilt rotor aircraft was developed. The mathematical model is used for evaluating aircraft performance and handling qualities. The model is based on an eleven degree of freedom total force representation. The rotor is treated as a point source of forces and moments with appropriate response time lags and actuator dynamics. The aerodynamics of the wing, tail, rotors, landing gear, and fuselage are included. Author

N73-31948*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CORNERING CHARACTERISTICS OF A 40 BY 14-16 TYPE 7 AIRCRAFT TIRE AND A COMPARISON WITH CHARACTERISTICS OF A C40 BY 14-21 CANTILEVER AIRCRAFT TIRE
John A. Tanner and Robert C. Dreher Washington Oct. 1973 26 p refs
(NASA-TN-D-7351; L-9046) Avail: NTIS HC $3.00 CSCL 01C

An investigation was conducted at the Langley aircraft landing loads and traction facility to determine the cornering characteristics of a 40 x 14-16 type VII aircraft tire. These characteristics, which include the cornering-force and drag-force friction coefficients and self-alining torque, were obtained for the tire operating on dry, damp and flooded runway surfaces over a range of yaw angles from 0 deg to 20 deg and at ground speeds from 5 to 100 knots, both with and without braking. The results of this investigation indicated that the cornering capability of the 40 x 14-16 type VII aircraft tire is degraded by high ground speeds, thin-film lubrication and tire hydroplaning effects on the wet surfaces, and brake torque. The cornering capability is greatly diminished when locked-wheel skids are encountered. Author

N73-31949*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FIXED-BASE SIMULATION STUDY OF TWO STOL AIRCRAFT FLYING CURVED, DESCENDING INSTRUMENT APPROACH PATHS
Margaret S. Benner, Richard H. Sawyer, and Milton D. McLaughlin Washington Oct. 1973 35 p
(NASA-TN-D-7298; L-8868) Avail: NTIS HC $3.00 CSCL 01C

A real-time, fixed-base simulation study has been conducted to determine the curved, descending approach paths (within passenger-comfort limits) that would be acceptable to pilots, the flight-director-system logic requirements for curved-flight-path guidance, and the paths which can be flown within proposed microwave landing system (MLS) coverage angles. Two STOL aircraft configurations were used in the study. Generally, no differences in the results between the two STOL configurations were found. The investigation showed that paths with a 1828.8 meter turn radius and a 1828.8 meter final-approach distance were acceptable without winds and with winds up to at least 15 knots for airspeeds from 75 to 100 knots. The altitude at roll-out from the final turn determined which final-approach distances were acceptable. Pilots preferred to have an initial straight leg of about 1 n. mi. after MLS guidance acquisition before turn intercept. The size of the azimuth coverage angle necessary to meet passenger and pilot criteria depends on the size of the turn angle: plus or minus 60 deg was adequate to cover all paths execpt ones with a 180 deg turn. Author

N73-31950*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT INVESTIGATION OF A STRUCTURAL MODE CONTROL SYSTEM FOR THE XB-70 AIRCRAFT
Wilton P. Lock, Eldon E. Kordes, James M. McKay, and John H. Wykes (N. Am. Rockwell Corp., Los Angeles) Washington Oct. 1973 83 p refs
(NASA-TN-D-7420; H-732) Avail: NTIS HC $3.75 CSCL 01C

A flight investigation of a structural mode control system termed identical location of accelerometer and force (ILAF) was conducted on the XB-70-1 airplane. During the first flight tests, the ILAF system encountered localized structural vibration problems requiring a revision of the compensating network. After modification, successful structural mode control that did not adversely affect the rigid body dynamics was demonstrated. The ILAF system was generally more effective in supersonic than subsonic flight, because the conditions for which the system was designed were more nearly satisfied at supersonic speeds. The results of a turbulence encounter at a Mach number of 1.20 and an altitude of 9754 meters indicated that the ILAF system was effective in reducing the vehicle's response at this flight condition. An analytical study showed that the addition of a small canard to the modal suppression system would greatly improve the automatic control of the higher frequency symmetric modes. Author

N73-31951*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
SIMULATOR EVALUATION OF THE LOW-SPEED FLYING QUALITIES OF AN EXPERIMENTAL STOL CONFIGURATION WITH AN EXTERNALLY BLOWN FLAP WING OR AN AUGMENTOR WING
Bruce G. Powers and David A. Kier Washington Oct. 1973 74 p refs
(NASA-TN-D-7454; H-780) Avail: NTIS HC $3.50 CSCL 01C

The low-speed flying qualities of an experimental STOL configuration were evaluated by using a fixed-base six-degree-of-freedom simulation. The configuration had either an externally blown flap (EBF) wing or an augmentor wing (AW). The AW configuration was investigated with two tails, one sized for the AW configuration and a larger one sized for the EBF configuration. The emphasis of the study was on the 70-knot approach task. The stability and control characteristics were compared with existing criteria. Several control systems were investigated for the normal four-engine condition and for the engine-out transient condition. Minimum control and stall speeds were determined for both the three- and four-engine operation. Author

N73-31952*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAMS FOR CALCULATING AND PLOTTING THE STABILITY CHARACTERISTICS OF A BALLOON TETHERED IN A WIND
Robert M. Bennett, Samuel R. Bland, and L. Tracy Redd Washington Sep. 1973 147 p refs
(NASA-TM-X-2740; L-8542) Avail: NTIS HC $4.50 CSCL 01B

Computer programs for calculating the stability characteristics of a balloon tethered in a steady wind are presented. Equilibrium conditions, characteristic roots, and modal ratios are calculated for a range of discrete values of velocity for a fixed tether-line length. Separate programs are used: (1) to calculate longitudinal stability characteristics, (2) to calculate lateral stability characteristics, (3) to plot the characteristic roots versus velocity, (4) to plot the characteristic roots in root-locus form, (5) to plot the longitudinal modes of motion, and (6) to plot the lateral modes for motion. The basic equations, program listings, and the input and output data for sample cases are presented, with a brief discussion of the overall operation and limitations. The programs are based on a linearized, stability-derivative type of analysis, including balloon aerodynamics, apparent mass, buoyancy

effects, and static forces which result from the tether line.
Author

N73-31953*# Rockwell International Corp., Downey, Calif.
A METHODOLOGY FOR HYPERSONIC TRANSPORT TECHNOLOGY PLANNING
E. M. Repic, G. A. Olson, and R. J. Milliken Washington NASA Sep. 1973 284 p refs
(Contract NAS1-6024)
(NASA-CR-2286; SD-73-SA-0019) Avail: NTIS HC $6.50 CSCL 01A

A systematic procedure by which the relative economic value of technology factors affecting design, configuration, and operation of a hypersonic cruise transport can be evaluated is discussed. Use of the methodology results in identification of first-order economic gains potentially achievable by projected advances in each of the definable, hypersonic technologies. Starting with a baseline vehicle, the formulas, procedures and forms which are integral parts of this methodology are developed. A demonstration of the methodology is presented for one specific hypersonic vehicle system. Author

N73-31954# Advisory Group for Aerospace Research and Development, Paris (France).
ESCAPE MEASURES FOR COMBAT HELICOPTER CREWS
Aug. 1973 39 p refs
(AGARD-AR-62) Avail: NTIS HC $4.00

A study was conducted to determine the requirements and characteristics of escape systems for use with helicopters. It was stated that escape systems are feasible, but that the rotary wing creates the greatest obstacle to emergency seat ejection. It was recommended that helicopter escape concepts be considered under the following categories: (1) an escape system for retrofit into helicopters already in production or in service, (2) an escape system for a near-term solution, and (3) an escape system for a far-term solution. The conclusion of the study was that a retrofittable escape system is practical only if it requires an absolute minimum of development time and does require major changes to the helicopter. The only likely canidates to satisfy the requirement are manual bailout or sideward ejection. Author

N73-31955*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STABILITY ANALYSIS AND TREND STUDY OF A BALLOON TETHERED IN A WIND, WITH EXPERIMENTAL COMPARISONS
L. Tracy Redd, Samuel R. Bland, and Robert M. Bennett Washington Oct. 1973 110 p refs Film Supplement Number L-1118 to this report is available on loan from NASA, Langley Res. Center, Hampton, Va. 23665
(NASA-TN-D-7272; L-8523) Avail: NTIS HC $4.25 CSCL 01C

A stability analysis and trend study for a balloon tethered in a steady wind are presented. The linearized, stability-derivative type analysis includes balloon aerodynamics, buoyancy, mass (including apparent mass), and static forces resulting from the tether cable. The analysis has been applied to a balloon 7.64 m in length, and the results are compared with those from tow tests of this balloon. This comparison shows that the analysis gives reasonable predictions for the damping, frequencies, modes of motion, and stability boundaries exhibited by the balloon. A trend study for the 7.64-m balloon was made to illustrate how the stability boundaries are affected by changes in individual stability parameters. The trends indicated in this study may also be applicable to many other tethered-balloon systems. Author

N73-31956*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT CALIBRATION TESTS OF A NOSE-BOOM-MOUNTED FIXED HEMISPHERICAL FLOW-DIRECTION SENSOR
Katharine H. Armistead and Lannie D. Webb Washington Oct. 1973 29 p refs
(NASA-TN-D-7461; H-779) Avail: NTIS HC $3.00 CSCL 01C

Flight calibrations of a fixed hemispherical flow angle-of-attack and angle-of-sideslip sensor were made from Mach numbers of 0.5 to 1.8. Maneuvers were performed by an F-104 airplane at selected altitudes to compare the measurement of flow angle of attack from the fixed hemispherical sensor with that from a standard angle-of-attack vane. The hemispherical flow-direction sensor measured differential pressure at two angle-of-attack ports and two angle-of-sideslip ports in diametrically opposed positions. Stagnation pressure was measured at a center port. The results of these tests showed that the calibration curves for the hemispherical flow-direction sensor were linear for angles of attack up to 13 deg. The overall uncertainty in determining angle of attack from these curves was plus or minus 0.35 deg or less. A Mach number position error calibration curve was also obtained for the hemispherical flow-direction sensor. The hemispherical flow-direction sensor exhibited a much larger position error than a standard uncompensated pitot-static probe. Author

N73-31957*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
APPLICATION OF COMPOSITES TO HELICOPTER AIRFRAME AND LANDING GEAR STRUCTURES Technical Report, Jul. 1972 - Feb. 1973
M. J. Rich, G. F. Ridgley, and D. W. Lowry Sep. 1973 138 p refs Sponsored in part by Army
(Contract NAS1-11688)
(NASA-CR-112333) Avail: NTIS HC $9.00 CSCL 01C

A design study has indicated that advanced composite helicopter airframe structures can provide significant system cost advantages. The most successful concept was found to be all-molded composite modular panels which provide integral skin/stringer and frame subassemblies. Based on present information it is estimated that a prototype composite airframe would cost approximately four percent more than a protoype metal frame. The difference is due primarily to the higher engineering design time, as the increased materials cost is largely offset by reduction of fabrication labor costs. Author

N73-31958*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
SUMMARY OF STABILITY AND CONTROL CHARACTERISTICS OF THE XB-70 AIRPLANE
Chester H. Wolowicz and Roxanah B. Yancey Washington Oct. 1973 56 p refs
(NASA-TM-X-2933; H-781) Avail: NTIS HC $3.50 CSCL 01C

The stability and control characteristics of the XB-70 airplane were evaluated for Mach numbers up to 3.0 and altitudes up to 21,300 meters (70,000 feet). The airplane's inherent longitudinal characteristics proved to be generally satisfactory. In the lateral-directional modes, the airplane was characterized by light wheel forces, low static directional stability beyond approximately 2 deg of sideslip, adverse yaw response to aileron inputs throughout the entire Mach number range, and negative effective dihedral with wingtips full down. At subsonic Mach numbers, with the flight augmentation control system off, the light wheel forces and adverse yaw response to aileron inputs caused the pilots to minimize use of the ailerons. At supersonic Mach numbers, with the augmentation system off, the adverse yaw due to aileron and the negative effective dihedral were conducive to pilot-induced oscillations. Author

N73-31959*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF GROUND AND FLIGHT TEST RESULTS USING A MODIFIED F106B AIRCRAFT
Fred A. Wilcox 1973 20 p refs Presented at 9th Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA and SAE
(NASA-TM-X-71439; E-7695) Avail: NTIS HC $3.00 CSCL 01C

Two aft underwing nacelles housing afterburning J85 engines were added to an F106 to study exhaust nozzles in flight at Mach numbers up to 1.3. Installation effects were determined for several nozzles by comparing flight data to data from an isolated wind tunnel model. Reynolds number effects were studied at subsonic flight speeds for nozzles intended for use with afterburning turbofan engines. A wide range of Reynolds number was obtained by flying the F106 over a range of altitude and by using 5 and 22% wind tunnel models of the F106. A contoured

nozzle had a boattail drag as low as that of a longer circular arc nozzle over the Reynolds number range studied. Author

N73-31960# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
RATIONAL CALCULATION OF DESIGN GUST LOADS IN RELATION TO PRESENT AND PROPOSED AIRWORTHINESS REQUIREMENTS
J. Yff [1973] 12 p refs Presented at AGARD Symp. on Flight in Turbulence, Bedfordshire, United Kingdom
(Fok-K66) Avail: NTIS HC $3.00

Accurately calculated gust loads for three short haul aircraft have been used to: (1) Compare PSD and discrete gust methods; (2) compare PSD mission analysis and design envelope results; (3) compare PSD results for vertical and lateral gusts; and (4) study in detail the specific problems of T-tails. Author

N73-31961# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
DESIGN STUDY OF AN ELECTRONIC LANDING DISPLAY FOR STOL AIRCRAFT [GEDANKEN ZUR AUSLEGUNG EINES ELEKTRONISCHEN LANDEDISPLAYS FUER STOL-FLUGZEUGE]
Wolfgang Holstein 1973 37 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(DGLR-Paper-73-038) Avail: NTIS HC $4.00

The design of landing display devices for STOL aircraft, was investigated on the basis of information presentation and information content. A proposal is made for a contact analogous landing display, which includes the perspective representation of the mean flight path, information about the actual flight status, predisplay of flight path coordinates, and boundary values for the flight parameters. An approach procedure using the improved display is described. ESRO

N73-31962# Technische Universitaet, Brunswick (West Germany). Inst. fuer Verkehr, Eisenbahnwesen und Verkerhssicherheit-Sonderforschungsbereich Flugfuehrung.
FLIGHT CONTROL PROBLEMS REGARDING STEEP APPROACH [FLUGFUEHRUNGSPROBLEME DES STEILANFLUGES]
R. Brockhaus 1973 35 p refs In GERMAN Presented at the DGLR-DGON Symp. of Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(DGLR-Paper-73-027) Avail: NTIS HC $3.75

Some problems concerning steep approach landings and in particular flight control, are discussed. The flight control problem was one of the main reasons the extreme requirements of vertical landing was relaxed, and why, with respect to flight equipment and flight methods, little difference is to be found between steep landing and conventional jet landing. Although all equipment necessary for steep landing is available, STOL traffic will be limited to approach angles of 6 deg, for economic reasons. ESRO

N73-31963# Technische Universitaet, Brunswick (West Germany). Lehrstuhl fuer Flugmechanik.
LONGITUDINAL MOTION OF AN AIR LINER DURING STEEP APPROACH [ZUR LAENGSBEWEGUNG EINES VERKEHRSFLUGZEUGS BEI STEILEN ANFLUEGEN]
G. Bruening, J. Lademann, and D. Schafranek 1973 24 p ref In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(DGLR-Paper-73-023) Avail: NTIS HC $3.25

Calculations were carried out on a Boeing 707 aircraft in order to assess the effects on longitudinal stability of steep approach landings. The investigations point out that the present passenger aircraft can perform steeper than usual landings. The sinking velocity will increase as the path velocity remains unchanged. In order to avoid too much throttling of the engines, the air brakes should be lowered. The dynamic longitudinal stability is only slightly disturbed. The angle of attack oscillation will be slightly undampened, the phugoid dampened. A glide path of 3 deg is recommended. ESRO

N73-31964# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
MONITOR DISPLAY FOR AUTOMATICALLY CONTROLLED STEEP APPROACH [EIN MONITORDISPLAY FUER AUTOMATISCH GEREGELTE STEILANFLUEGE]
Hans-Dieter Schenk and Josef Thomas 1973 8 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(DGLR-Paper-73-031) Avail: NTIS HC $3.00

A display for monitoring automatic steep approach was designed. This display shows a sideways view of the curved approach profile with a mobile aircraft symbol and a rotating flight path vector. The equipment was investigated in a flight simulator, and improved. A flight test, as well as further investigations concerning the operational usefulness of the equipment, are in preparation. ESRO

N73-31965# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
FLIGHT MECHANICAL PROBLEMS IN LANDING APPROACH WITH DIRECT LIFT CONTROL, EXEMPLIFIED BY HFB 320 HANSA [FLUGMECHANISCHE PROBLEME BEIM LANDEANFLUG MIT DIREKTER AUFTRIEBSSTEUERUNG AM BEISPIEL DER HFB 320 HANSA]
D. Hanke and H.-H. Lange 1973 32 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-5 May 1973
(DGLR-Paper-73-024) Avail: NTIS HC $3.75

A possibility for reducing flight control problems in steep approach landing by direct lift control is discussed. The possibilities and limitations of direct lift controls are presented for the HFB 320 Hansa aircraft, by means of simulation and flight results. The first experiences with steep, noise-reducing, 2 segment approaches, using the HFB 320, are reported. ESRO

N73-31966# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
EFFECTS, AND THEIR SIGNIFICANCE OF NEW APPROACH METHODS ON COCKPIT DESIGN [AUSWIRKUNGEN NEUER ANFLUGVERFAHREN AUF DIE COCKPITAUSLEGUNG UND MOEGLICHKEITEN IHRER BERUECKSICHTIGUNG]
Haeuser 4 May 1973 23 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(MBB-UH-07-73-O; DGLR-Paper-73-033) Avail: NTIS HC $3.25

The layout of cockpits is discussed in view of new landing approach methods. Parameters for cockpit layouts, based on the flight control functions to be executed, are developed, and modifications are introduced as a result of new approach methods. ESRO

N73-31967# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
CONTROL TECHNIQUE IN STEEP APPROACH OF ROTARY WING AIRCRAFT [REGELUNGSTECHNIK BEI STEILANFLUEGEN VON DREHFLUEGLERN]
Wolfgang Kubbat May 1973 26 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(MBB-UFE-1021-O; DGLR-Paper-73-029) Avail: NTIS HC $3.50

Feedback control for flexible landing approach profiles of rotary wing aircraft was investigated. The feedback control circuit, in which the state vector contains 8 variables, is described. Solutions to the linearized state equation are illustrated by examples with results of simulation, during which straight-line, curved, and spatially curved approaches were investigated. ESRO

N73-31968# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
NOISE REDUCING METHODS FOR STOL AIRCRAFT APPROACH AND TAKE-OFF [LAERMREDUZIERENDE AN- UND ABFLUGVERFAHREN FUER STOL-FLUGZEUGE]
K. Weise and H. Anders 3 May 1973 43 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und

Landeverfahren, Duesseldorf, 2-4 May 1973
(MBB-UH-06-73-O; DGLR-Paper-73-039) Avail: NTIS HC $4.25

The noise propagation of three projected STOL aircraft was investigated during takeoff and approach flight. It was shown that takeoff noise can be reduced a few dB by thrust reduction (three segment takeoff profile) near airports. As with CTOL aircraft, the landing paths should be as steep as possible, and landing flaps and gear should be lowered at low altitude. By using all possibilities during landing, obtainable noise reduction can be considerable. Keeping to the exact flight path was also found to be noise reducing. ESRO

N73-31969# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
STEEP APPROACH LIMITS FOR ROTARY WING AIRCRAFT [UEBER DIE GRENZEN VON STEILANFLUEGEN MIT DREHFLUEGLERN]
M. Rade 1973 8 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(MBB-UD-101-73-O; DGLR-Paper-73-026) Avail: NTIS HC $3.00

The flight characteristics and boundary conditions which affect a steep approach are described for rotary wing aircraft. The limits for steep instrument approach are presented, and experiences in flight operation are depicted. Essential advantages are shown for a flight path angle of 15 deg over the ILS approach. Some necessary prerequisites for a steep landing approach by instruments are briefly considered. ESRO

N73-31970# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
PROBLEMS INVOLVED IN DEVELOPING AN INTEGRATED FLIGHT CONTROL SYSTEM WITH EMPHASIS ON CURVED FLIGHT PATH PROFILES [REALISIERUNGSPROBLEME EINES INTEGRIERTEN FLUGREGELUNGSSYSTEMS UNTER BESONDERER BERUECKSICHTIGUNG GEKRUEMMTER FLUGBAHNPROFILE]
H. Boehret 1973 32 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(DGLR-Paper-73-030) Avail. NTIS HC $3.75

An integrated flight control system, FRG 70, which is especially adapted to curved flight path profiles, is presented. The feedback control parameters are coupled to elevators and thrust, which limitation facilitates the realization of this principle. The system is characterized by a precise matching to the aerodynamic flow conditions and high passenger comfort. The exact path guidance is supported by a path angle dependent thrust control, allowing for larger thrust rest. The properties of the integrated system were analyzed during over 500 automatic approaches and landings. They can be improved by direct lift controls and by using a monitor display. ESRO

N73-31971# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
COMPARISON OF METHODS FOR FLIGHT TESTS AND THEIR EVALUATION FOR THE DETERMINATION OF CHARACTERISTICS AND PERFORMANCE OF MODERN JET AIRCRAFT [VERGLEICH VON VERFAHREN ZUR DURCHFUEHRUNG UND AUSWERTUNG VON FLUGVERSUCHEN ZUR BESTIMMUNG VON EIGENSCHAFTEN UND LEISTUNGEN MODERNER STRAHLFLUGZEUGE]
U. VonMeier, H. Ruf, H. Friedrich, W. Kohl, H. J. Munser, and H. Wuennenberg Bonn Bundeswehramt 1973 169 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. Fuer Verteidigung
(BMVg-FBWT-73-12) Avail: NTIS HC $10.50; Bundeswehramt 25 DM

Five techniques for analyzing the stability derivatives of a G91T aircraft were compared. They included manual evaluation of special flight maneuvers, time vector method, forced oscillation method, analog matching, and regression analysis. Parameters taken into account were elapsed time, equipment for flight tests, data reduction, and result quality. It was shown that several measuring and evaluation techniques should be used in parallel. The advantages and disadvantages of the different techniques are discussed. ESRO

N73-31972# Calspan Corp., Buffalo, N.Y.
DEVELOPMENT AND EVALUATION OF AN AUTOMATIC DEPARTURE PREVENTION SYSTEM AND STALL INHIBITOR FOR FIGHTER AIRCRAFT Final Report
Robert T. N. Chen, Fred D. Newell, and Arno E. Schelhorn Wright-Patterson AFB, Ohio AFFDL Apr. 1973 126 p refs (Contract F33615-72-C-1162; AF Proj. 8225; AF Proj. 8219)
(AD-764767; CALSPAN-AK-5112-F-1; AFFDL-TR-73-29) Avail: NTIS CSCL 01/3

The report documents the conceptual design, breadboard development and pilot-in-the-loop evaluation of an automatic departure prevention system and a stall inhibitor for fighter aircraft. Using the A-7D as the study aircraft, a departure boundary characterized by alpha and beta was determined from the available data. This departure boundary was then used to help design an automatic departure preventer and a stall inhibitor. An automatic departure prevention device as described in the report works smoothly and will benefit the A-7 aircraft. With just the departure preventer, the pilots could maneuver freely, with great confidence and use the full capability of the airplane, well beyond the present departure boundary. (Modified author abstract) GRA

N73-31973# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PREDICTING HEADING TASK FLYING QUALITIES WITH PAPER PILOT M.S. Thesis
Calvin Ronald Taylor Jun. 1973 136 p refs
(AD-764695; GE/MA/73-1) Avail: NTIS CSCL 01/3

A mathematical model for predicting the pilot rating of a fighter aircraft in a precision heading task is described. The model includes the lateral-directional aircraft equations of motion, a stochastic gust model, a pilot model with four free pilot parameters, and a pilot rating expression that is a function of rms heading angle, rms yaw rate, and rms roll rate. The pilot gains and lead time constants are selected to minimize the pilot rating expression. The resulting minimum is used to compute a heading paper pilot rating. The heading paper pilot rating was computed for 32 flight conditions at different gust intensities for the F-5 and A-7 aircraft. Heading paper pilot ratings agree well with the actual ratings for the F-5, but are low for the A-7. In addition, there is good correlation between computed and actual rms heading angle, rms yaw rate, and rms slideslip. Author (GRA)

N73-31974# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN IMPROVED METHOD OF PREDICTING AIRCRAFT LONGITUDINAL HANDLING QUALITIES BASED ON THE MINIMUM PILOT RATING CONCEPT M.S. Thesis
John D. Arnold Jun. 1973 152 p refs
(AD-764696; GGC/MA/73-1) Avail: NTIS CSCL 01/3

A fixed-base simulation of some of the flight tests in the USAF/CAL variable stability T-33 aircraft was performed. The task was maintaining pitch attitude in the presence of vertical turbulence. The root-mean-square state data and parameters in a linear pilot model were determined from the simulation. These items were correlated with the Cooper-Harper Pilot Ratings. This led to the development of a pilot-rating expression based on rms state errors and pilot workload. This rating expression was used in a digital computer program to accurately predict pilot ratings and rms state errors using only the aircraft stability derivatives, airspeed, and altitude as inputs. Author (GRA)

N73-31975# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN AND INVESTIGATION OF A WIND-SHEAR-PROOF CONTROL SYSTEM FOR AUTOMATIC LANDING M.S. Thesis
Louis G. Trivett Jun. 1973 91 p refs
(AD-764697; GGC/MA/73-4) Avail: NTIS CSCL 01/2

An analog computer simulation of the longitudinal portion of an All-Weather Landing System is presented. The linearized longitudinal equations of motion of a DC-8 aircraft during landing approach are converted to state-variable form to facilitate the analog simulation. An Advanced Automatic Flight Control

System is added and the approach phase of an automatic landing is simulated. A severe turbulence atmospheric environment consisting of wind gusts and wind shears is an integral part of the simulation. A systematic method is presented for developing a Kalman Filter based wind-shear-proofing system to reduce deviations from glide slope caused by wind shears. (Modified author abstract) GRA

N73-31976# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PREDICTING PITCH TASK FLYING QUALITIES USING PAPER PILOT M.S. Thesis
Robert B. Johnson Jun. 1973 155 p refs
(AD-764698; GGC/MA/73-2) Avail: NTIS CSCL 01/3

A mathematical model for predicting the pilot rating of an aircraft in a pitch tracking task is described. The model includes the longitudinal-directional aircraft equations of motion, a stochastic gust model, a pilot model with two free parameters, and a pilot rating expression that is a function of rms pitch angle, rms pitch rate, and the pilot lead time constant. The pilot parameters are then adjusted to provide at least a 20% stability margin, and the adjusted pilot parameters are used to compute a Flypaper Pilot rating of the aircraft/gust configuration. The Flypaper Pilot rating was computed for 32 aircraft/gust configurations. A range of actual ratings from 2 to 8 was encountered and the Flypaper Pilot ratings agree quite well with the actual ratings. Author (GRA)

N73-31977# Uniroyal Tire Co., Detroit, Mich.
CONTINUOUS WOUND TOROIDAL AIRCRAFT TIRE Final Report, 17 Mar. 1970 - 9 Feb. 1973
Edwin Sj English and Jerome J. Wojciechowski Mar. 1973 35 p
(Contract F33615-70-C-1775; AF Proj. 1369)
(AD-764888; AFFDL-TR-73-35) Avail: NTIS CSCL 01/3

The primary objective of the program was to establish basic design requirements for a toroidal continuous wound aircraft tire concept. Using these basic design requirements, tires were fabricated and shipped to the Flight Dynamics Laboratory at WPAFB for their evaluation so as to aid in determining the performance characteristics of the toroidal tire concept on military aircraft applications. Author (GRA)

N73-31978# Battelle Columbus Labs., Ohio. TACTEC
LIGHTNING PROTECTION MEASURES FOR LOW-ALTITUDE TETHERED BALLOON SYSTEMS
P. E. Eggers, J. B. Brown, Jr., and R. C. Ollila May 1973 92 p refs
(Contract DAAH01-72-C-0982; ARPA Order 2209)
(AD-764651; A-4038(LP)) Avail: NTIS CSCL 09/1

The findings of a comprehensive review of information relating to state-of-the-art techniques for atmospheric electrical protection are reported for both ground-based (tall buildings, towers, power transmission lines) and airborne (aircraft, rockets) systems. An assessment has been made as to the applicability of this information to the protection of tethered balloons. Candidate techniques for the atmospheric electrical protection of balloons with conducting and nonconducting tethers are discussed. In addition, the results of investigative studies of the technical feasibility of air-ionization techniques for lightning protection are discussed. Author (GRA)

N73-31979# Naval Aerospace Medical Research Lab., Pensacola, Fla.
HUMAN FACTORS APPROACH TO AIRCRAFT ACCIDENT ANALYSIS
Richard H. Shannon and Wayne L. Waag 18 Jun. 1973 46 p refs
(AD-764868; NAMRL-1184) Avail: NTIS CSCL 01/2

Naval Accident reports involving the P-3 and F-4 aircraft were examined over seven and five-year periods, respectively. The critical incident technique was used to catalogue, describe, and analyze operational flight crew errors in both aircraft. An in-depth study was performed in order to identify those problems which were common as well as specific to both aircraft. The P-3 and F-4 aircraft were selected because of their completely different fleet missions and handling characteristics. From the F-4 accident reports, 437 human errors were isolated while the P-3 reports contained 345 errors. Twenty-eight major error categories emerged from the analysis of these errors. The accident reports were further analyzed for the errors which both aircraft had in common. Twenty common error groups were found to occur in the P-3 and the F-4, representing 22.9% and 18.8% of the total errors, respectively. The flight segment of Takeoff/Landing, and the error type of Procedures, shared the most commonality across the two aircraft. The results of this investigation suggest that although common errors can be isolated across highly dissimilar aircraft with highly different flight missions, they comprise a relatively small percentage of total errors. By far, the majority of errors concerned characteristics unique to the particular aircraft in question. Implications in the remedial areas of crew coordination, training, discipline and design are discussed. Author (GRA)

N73-31980# CADCOM, Inc., Annapolis, Md.
SIMULATION OF THE COMPATIBILITY OF AN AIR CAPABLE SHIP AND A VTOL AIRCRAFT Final Report, 16 Jun. 1972 - Mar. 1973
George H. Daffer and David F. Rogers Mar. 1973 208 p refs
(Contract N00014-72-C-0531; NR Proj. 215-208)
(AD-764865; CADCOM-73-6) Avail: NTIS CSCL 01/3

An interactive computer simulation, LARC-I, has been designed to solve the non-linear equations of motion of a generalized VTOL aircraft taking off from or landing on the deck of a ship moving in an irregular or random seaway. This version of LARC-I is limited to longitudinal motions, but is designed for eventual expansion to all degrees of freedom. The LARC-I programs makes use of ship motion amplitudes and frequencies derived separately in a ship motions program, wherein the forcing functions of the seaway are based on a stochastic representation of the waves for any given sea state. The pitching and heaving motions of the ship are transmitted to the aircraft by a realistic simulation of the landing gear. (Modified author abstract) GRA

N73-31981# Defense Documentation Center, Alexandria, Va.
HELICOPTER ENGINES AND ROTORS Report, Bibliography, Jan. 1968 - Mar. 1973
Jul. 1973 454 p refs
(AD-764900; DDC-TAS-73-48) Avail: NTIS CSCL 01/3

The bibliography comprises annotated citations of 300 unclassified reports dealing with helicopter engines and rotors. The following references are on some of the topics dealing with the subject: helicopter engines, rotor materials, rotor hover, rigid rotors, hot cycle rotors, rotor blades, heavy-lift rotors, rotor noise, and flight control systems. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N73-31982# State Univ. of New York, Buffalo. Dept. of Biology.
REDUCTION OF THE BAT HAZARD TO USAF AIRCRAFT Annual Report, 1 Jun. 1972 - 31 May 1973
Timothy C. Williams 31 May 1973 10 p refs
(Grant AF-AFOSR-2123-71; AF Proj. 9777)
(AD-764828; AFOSR-73-1256TR) Avail: NTIS CSCL 01/2

Work has concentrated in four areas; analysis of emergence pattern and correlation with weather conditions; test and evaluation of bat avoidance program at Randolph Air Force Base; use of tracking radar for following bat flight; and effects of strobe lights in bat dispersal. Data indicates there is a tendency for certain flight formation to occur with certain synoptic conditions such as the passage of a cold front. A test of the proposed avoidance program involving three way communication between TRACON radar, weather radar and control approach was 100 percent successful. Data indicate tracking radar can be used and gives a three dimensional picture of bat movements. It was demonstrated that bats avoided areas where high intensity strobe lights were in operation but extensive tests were not performed due to possible visual damage to ground personnel and it is unknown if bats will habituate to strobes. (Modified author abstract) GRA

N73-31983# Johns Hopkins Univ., Baltimore, Md. School of Hygiene and Public Health.
BIRD/AIRCRAFT HAZARDS ASSOCIATED WITH MIGRA-

TION OF LARGE BIRDS IN CONGESTED AIR ROUTES Final Report, Jan. - May 1973
William J. L. Sladen Jun. 1973 10 p
(Grant AF-AFOSR-2457-73; AF Proj. 9777)
(AD-764830; AFOSR-73-1252TR) Avail: NTIS CSCL 01/2

A total of 12 Whistling Swans were harnessed with transmitters. The first two were harnessed at Mattamuskeet National Wildlife Refuge in February and have not been reported since then. The rest of the radios were put on swans at the Blackwater Wildlife Center in March. One of these swans migrated abnormally late and one swan died of apparent lead poisoning. The group located all eight of the remaining radios in the Detroit area after tracking precisely by plane five of the seven radios from Maryland. A flight history of altitude, route, speed, etc., is available. Five of the swans were relocated in North Dakota and one in Minnesota. Two of the five were tracked by plane into Saskatchewan. Important information on evasive action of swans to small aircraft was obtained. An important aspect of predictability of hazard of large waterfowl to aircraft is the need for knowledge of how many birds are massing in staging areas. Air photo flights were made just prior to the major Chesapeake migration and where possible ground counts were made as well as how altitude photography. These three methods are being analyzed. Author (GRA)

N73-31984# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
HIGHER HARMONIC CIRCULATION CONTROL ROTOR MODEL - MODEL INSTRUMENTATION AND DATA ACQUISITION
Michael B. Stone Apr. 1973 44 p refs
(AD-765320; TN-AL-288) Avail: NTIS CSCL 01/3

A higher harmonic circulation control rotor was tested in the 8 ft x 10 ft subsonic wind tunnel at various advance ratios, blade tip Mach numbers, blowing air pressures, shaft angles and collective angles. The model was instrumented with strain gages, pressure transducers, thermocouples, magnetic pick-ups and a pitch-roll trim resolver. This information was recorded on an analog to digital acquisition system and on F.M. tape recorders for later digitization. The purpose of the report is to provide descriptive documentation of the model instrumentation and data acquisition portion of the test, and there is no attempt made to elaborate on helicopter or higher harmonic theory.
Author (GRA)

N73-31985# San Diego Aircraft Engineering, Inc., Calif.
CONCEPTUAL DESIGN OF A AIR CUSHION LANDING SYSTEM FOR AN UNMANNED AIRCRAFT Final Report, 27 Mar. - 11 Aug. 1972
Henry B. McCudden, Paul D. Sorensen, George R. Lutz, William H. Stewart, and Donald R. Walborn 3 Jan. 1973 126 p refs
(Contract F33615-72-C-1769; AF Proj. 1369)
(AD-764774; SAE-72-031; AFFDL-TR-72-155) Avail: NTIS CSCL 01/3

The problems associated with existing recovery systems include difficulty in mid-air retrieval of RPV's in excess of 1500 lbs; high operations and support costs of parachutes, recovery helicopters, other aircraft and their crews; long recycle time; paving quality requirements for wheeled or skid type landing gear; and frequent damage of RPV's recovered by parachute/attenuation bag or parachute/mid-air recovery systems. Accordingly, this preliminary design study report describes an air cushion landing system (ACLS) applied to the 3,000 lb Jindivik Mk 3A unmanned aircraft. The ACLS is stowed for cruise flight in a clean aerodynamic fairing on the underfuselage, resulting in a minimum performance degradation. For recovery, hinged clam-shell type doors are unlatched, and open, permitting inflation/deployment of an inelastic type elongated toroid-shaped trunk. The trunk is inflated and blown with bleed air tapped off an existing port on the Jindivik's Viper Mk 201 engine. After landing, the aircraft is placed on a fixture and the trunk is manually restowed in the fairing. (Modified author abstract) GRA

N73-31986# Lockheed-California Co., Burbank.
EXPERIMENTAL PROGRAM FOR THE DEVELOPMENT OF IMPROVED HELICOPTER STRUCTURAL CRASHWORTHINESS ANALYTICAL AND DESIGN TECHNIQUES. VOLUME 2: TEST DATA AND DESCRIPTION OF AN UNSYMMETRICAL CRASH ANALYSIS COMPUTER PROGRAM, INCLUDING A USER'S GUIDE AND SAMPLE CASE
Gilbert Wittlin and Max A. Gamon May 1973 251 p refs
(Contract DAAJ02-71-C-0066; DA Proj. 1F1-62203-A-529)
(AD-764986; USAAMRDL-TR-72-72B) Avail: NTIS CSCL 01/2

Volume 2 contains supporting data for the details presented in Volume I. The report contains abstracts for the 32 technical reports reviewed during the program. Included in the literature survey section is a matrix categorization of the reports by subject and applicable areas of interest. A brief description is presented on STAGS, the LMSC computer program used to perform the analysis of the P2V-4 fuselage bumper. A comprehensive description of program KRASH is presented, including the theory, initial conditions, the User's Guide, and a sample problem. Twenty-six channels of recorded test data and film data are presented in another section. Additional analytical data are presented in the last section. Author (GRA)

N73-31987# Battelle Columbus Labs., Ohio.
AN EVALUATION OF THE FEASIBILITY OF UTILIZING BALLOON SYSTEMS FOR THE SHIP-TO-SHORE TRANSPORT OF MILITARY CARGO Final Report
C. Dudley Fitz, Richard A. Egen, James O. Frankosky, and Douglas K. Blue Jun. 1973 108 p refs
(Contract DAAH01-72-C-0982; DAAH01-73-C-0142)
(AD-765352) Avail: NTIS CSCL 15/5

The overall objective of the report was to provide an evaluation of the feasibility of using a Balloon Transport System (BTS) for transporting military cargo from ship to shore. These experimental and theoretical tasks concentrated upon the techniques for offloading, shoreward movement, and placement of containers, which provide the basic means of transporting military cargo. During the performance of these tasks, consideration was given to the military requirements for load capacity, discharge rate, range, safety, accuracy, reliability, mobility, and survivability in the ship-to-shore movement of containerized cargo, employing standard MILVANs - which are 8 feet high, 8 feet wide, and 20 feet long, and have a fully loaded weight of 22.5 tons. GRA

N73-32853* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
TECHNOLOGY FOR DESIGN OF TRANSPORT AIRCRAFT. LECTURE NOTES FOR MIT COURSES: SEMINAR 1.61 FRESHMAN SEMINAR IN AIR TRANSPORTATION AND GRADUATE COURSE 1.201, TRANSPORTATION SYSTEMS ANALYSIS
Robert W. Simpson *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 50 p (For availability see N73-32848 23-34)
CSCL 01C

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-31988* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
POWERPLEXER Patent
Joseph M. Woods, inventor (to NASA) Issued 28 Aug. 1973 10 p Filed 31 May 1972 Supersedes N72-27063 (10 - 18, p 2380)
(NASA-Case-MSC-12396-1; US-Patent-3,755,686;
US-Patent-Appl-SN-258331; US-Patent-Class-307-18;
US-Patent-Class-307-28; US-Patent-Class-307-29;
US-Patent-Class-307-38) Avail: US Patent Office CSCL 10A

An electrical power distribution system is described for use in providing different dc voltage levels. A circuit is supplied with DC voltage levels and commutates pulses for timed intervals onto a pair of distribution wires. The circuit is driven by a command generator which places pulses on the wires in a timed sequence. The pair of wires extend to voltage strippers connected to the

various loads. The voltage strippers each respond to the pulse dc levels on the pair of wires and form different output voltages communicated to each load.
Official Gazette of the U.S. Patent Office

N73-31989*# Auburn Univ., Ala. Electrical Engineering Dept.
A STUDY OF POWER CONDITIONING AND POWER DISTRIBUTION AND COMPONENTS Final Report
Hubert Merrill Horton and M. A. Honnell Jan. 1973 126 p refs
(Contract NAS8-26752)
(NASA-CR-124445) Avail: NTIS HC $8.50 CSCL 10B

A comprehensive simulation and analysis performed on the operation of the regulator part of the Charger/Battery/Regulator Module (CBRM) are detailed. The CBRM is utilized as an integral component of the Skylab/Apollo Telescope Mount (ATM) electrical power system and contains a switching mode electronic regulator. Implementing circuit analysis techniques, pertinent voltages and currents are calculated; these, in turn, are incorporated into the regulator system study. Investigation of the turn-on and turn-off times associated with the switching circuitry is performed and an examination is made on these calculations. A simulation model computer program is utilized to generate graphs that relate various CBRM parameters to one another. Author

N73-31990*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY CONSERVATION ALTERNATIVES TO NUCLEAR POWER, A CASE STUDY
Robert F. Mueller Jul. 1973 36 p refs
(NASA-TM-X-70468; X-644-73-205) Avail: NTIS HC $4.00 CSCL 10A

It is demonstrated that electric resistance heating and commercial lighting represent the greatest demand factors on the projected increase in electrical generating capacity. By use of conservative assumptions a quantity of electrical generating capacity in excess of that of a proposed nuclear power plant or 2,200 megawatts, can be saved chiefly through the avoidance of electric resistance heating and the institution of greater lighting efficiency. Many additional and alternative savings of energy and generating capacity could also result from such strategies as total energy systems and solar heating and air conditioning.
Author

N73-31991*# Techtran Corp., Glen Burnie, Md.
CALCULATION AND COMPARISON OF THE ECONOMICS OF ELECTROCHEMICAL FUEL CELLS
F. A. Pohl, J. Boehm, and H. Carl Washington NASA Oct. 1973 17 p refs Transl. into ENGLISH from Wiss. Ber. AEG-Telefunken (West Germany), v. 45, no. 3, 1972 p 141-146
(Contract NASw-2485)
(NASA-TT-F-15147) Avail: NTIS HC $3.00 CSCL 10A

The economic benefits are considered to be derived from various types of electrochemical fuel cells. It is found that the tungsten carbide-carbon cell is most economic in the low temperature fuel cell range, and that high fuel costs are more significant than high investment costs. Author

N73-31992*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF A COMBINED REFRIGERATOR-GENERATOR SPACE POWER SYSTEM
John L. Klann 1973 18 p refs Presented at Cryog. Cooler Conf., Colorado Springs, Colo., 16-17 Oct. 1973; sponsored by Air Force
(NASA-TM-X-71433; E-7683) Avail: NTIS HC $3.00 CSCL 10B

Compatibility of the Brayton power and refrigeration cycles is considered. Performance of the power- and cryo-loop is plotted against compressor pressure ratio. The power- and cryo-loop performance is determined by dividing the compressor work between the two loops in proportion to mass flow rate. Cycle efficiency is defined as the ratio of shaft power available in the power loop to the net thermal input from the heat source. The available shaft power is the excess of the power turbine work over the compressor work needed in the power loop. The best power loop efficiency occurred at a compressor pressure ratio of 1.8, and the best cryo-loop performance was at a compressor pressure ratio of 2.1. Good individual cycle performance occurred over a fairly large range in compressor pressure ratio. Author

N73-31993*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMOELASTIC ANALYSIS OF SOLAR CELL ARRAYS AND THEIR MATERIAL PROPERTIES
M. A. Salama, W. M. Rowe, and R. K. Yasui 1 Sep. 1973 112 p refs
(Contract NAS7-100)
(NASA-CR-135713; JPL-TM-33-626) Avail: NTIS HC $7.75 CSCL 10A

A thermoelastic stress analysis procedure is reported for predicting the thermally induced stresses and failures in silicon solar cell arrays. A prerequisite for the analysis is the characterization of the temperature-dependent thermal and mechanical properties of the solar cell materials. Extensive material property testing was carried out in the temperature range -200 to +200 C for the filter glass, P- and N-type silicon, interconnector metals, solder, and several candidate silicone rubber adhesives. The analysis procedure is applied to several solar cell array design configurations. Results of the analysis indicate the optimum design configuration, with respect to compatible materials, effect of the solder coating, and effect of the interconnector geometry. Good agreement was found between results of the analysis and the test program. Author

N73-31994*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MONITORING AND CONTROL OF FUEL-CELL SYSTEM BY DIGITAL COMPUTER
Norman H. Hagedorn and Ralph D. Thomas Washington Oct. 1973 10 p refs
(NASA-TM-X-2923; E-7475) Avail: NTIS HC $2.75 CSCL 10A

The computer was programmed to handle data, perform limit checks, control normal operation, take corrective actions, and initiate shutdown for a fuel-cell system. The system was operated under computer control for periods up to 30 hr. The adequacy of the programming and interfacing techniques used was verified. Author

N73-31995# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
ELECTROFORMED ALUMINUM SOLAR CELL CONTRACTS Final Technical Report, 1 Feb. 1972 - 30 Mar. 1973
Peter A. Iles Mar. 1973 45 p
(Contract F33615-72-C-1427; AF Proj. 3145)
(AD-764816; AFAPL-TR-73-29) Avail: NTIS CSCL 10/2

Investigations were conducted to evaluate the feasibility of achieving improved aluminum solar cell contacts and interconnects which could reduce overall solar array cost and weight without sacrifice of performance and reliability. Problems of poor adherence and thickness control of the contact metallization were encountered during the course of the program. Efforts to resolve these problems were unsuccessful. Because of the serious contact metallization problems, no effort was expended in attempting to achieve advanced wrap-around contact configurations or interconnection of cells using the electroforming technique. Author (GRA)

N73-31996# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETOHYDRODYNAMIC GENERATOR FOR A COMBINED MAGNETOHYDRODYNAMIC ELECTRIC POWER PLANT WITH A FIRST GENERATION OPEN CYCLE
B. Ya. Shumyatskii, M. G. Koryagina, P. P. Ivanov, and V. I. Kovbasyuk 31 Jul. 1973 28 p refs Transl. into ENGLISH from unidentified Russian monograph
(AF Proj. 3145)
(AD-764925; FTD-MT-24-713-73) Avail: NTIS CSCL 10/2

Contents: Preliminary analysis of the best magnetic systems; Variation problem in the technical and economical optimization of an MHD generator; Characteristics of optimum MHD generators. GRA

N73-32840* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STUDY OF INTERACTION AMONG SILICON, LITHIUM, OXYGEN AND RADIATION-INDUCED DEFECTS FOR RADIATION-HARDENED SOLAR CELLS
P. A. Berman *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 33-44 refs (For availability see N73-32836 23-34)
CSCL 10A

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-31997*# Kanner (Leo) Associates, Redwood City, Calif.
EVALUATION OF GAS EXCHANGE AND REACTION OF THE CARDIOVASCULAR AND RESPIRATORY SYSTEMS TO PHYSICAL WORK
Washington NASA Sep. 1973 7 p Transl. into ENGLISH of "Otsenka Gazoobmena i Reaktsiy Serdechno-Sosudistoy i Dykhatelnoy Sistem Na Fizicheskuyu Rabotu", Acad. of Sci. USSR, Moscow, report, 1973 6 p
(Contract NASw-2481)
(NASA-TT-F-15090) Avail: NTIS HC $3.00 CSCL 06P

Data are produced on the energy expenditures of an astronaut with various physical loads on the bicycle ergometer, as well as the functioning of the cardiovascular and respiratory systems under conditions of physical stress. The data produced allows better estimates of the functional state of the organism of the astronaut and its changes under the influence of flight factors. The reactions of the casdiovascular and respiratory systems to physical loadings of low intensity, performed in the prone and sitting positions, can be used to evaluate the specific role of deterioration of orthostatic stability in the reduction of the physical working ability of an astronaut. Performance of maximum physical work during the annual examinations of astronauts can better be used to evaluate their state of training and the functional condition of their organism. Author

N73-31998*# Kanner (Leo) Associates, Redwood City, Calif.
THE MEASUREMENT OF ARTERIAL PRESSURE UNDER THE INFLUENCE OF ODNT
Washington NASA Sep. 1973 4 p Transl. into ENGLISH from Acad. of Sci. (USSR), 1973 2 p
(Contract NASw-2481)
(NASA-TT-F-15087) Avail: NTIS HC $3.00 CSCL 06P

The method is reported of investigating arterial pressure consists of measurement of pressure in the left brachial artery before, during and after ODNT. The accuracy of the method is + or - 5 mm hg. Author

N73-31999*# Grambling Coll., La.
THE EFFECT OF CONTINUOUS LOW DOSE-RATE GAMMA IRRADIATION ON CELL POPULATION KINETICS OF LYMPHOID TISSUE Semiannual Status Report
Bessie Ruth Foster 13 Jul. 1973 23 p refs
(Grant NGR-19-011-008; NSF GB-29136)
(NASA-CR-135723; SASR-4) Avail: NTIS HC $3.25 CSCL 06R

The problem studied involved cell proliferation in mice thymus undergoing irradiation at a dose rate of 10 roetgens/day for 105 days. Specifically, the aim was to determine wheather or not a steady state of cell population can be established for the indicated period of time and what compensatory mechanisms of cell population are involved. Author

N73-32000*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPHTHALMIC LIQUEFACTION PUMP Patent Application
Edward F. Baehr, Jack B. Esgar, and William J. McGannon, inventors (to NASA) Filed 14 Sep. 1973 17 p
(NASA-Case-LEW-12051-1; US-Patent-Appl-SN-397478) Avail: NTIS HC $3.00 CSCL 06E

A surgical tissue macerating and removal tool is disclosed wherein a rotating member having a cutting tip is utilized. When the instrument is to be used in an eye, a treatment fluid is supplied to the operative site and a first pump is provided to evacuate macerated material and treatment fluid from the eye. The rotating member may be disposed in a support tube having an aperture and communication with the first pump to provide for discharge of the macerated material and used treatment fluid. A second pump means is provided on the rotating member to provide a counter flow of treatment fluid into the space between the rotating member and the support tube. The second pump may provide additional support for the rotating member. A method is also provided for axially positioning rotating member to increase or decrease cutting action. NASA

N73-32001*# Scientific Translation Service, Santa Barbara, Calif.
EFFECTS OF CERTAIN EXTREME STRESSES ON THE STRUCTURE OF THE VASCULAR SYSTEM
M. G. Prives Washington NASA Oct. 1973 23 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), v. 58, no. 4, 1970 p 9-19
(Contract NASw-2483)
(NASA-TT-F-15081) Avail: NTIS HC $3.25 CSCL 06S

The latest data on structural changes associated with adaptation of the body to certain stressful factors, i.e., gravitation, immobility, penetrating radiations, prevailing during flight in supersonic planes or spacecraft are reported. Disturbance of haemodynamics alone can hardly account for all the alterations affecting the blood stream, therefore neurohumoral regulation of all bodily functions, as well as haemodynamic factors, appear to be more plausible. In one and the same organ arteries and veins may be affected differently on exposure to the same stress. Changes affecting the lymphatic system are similar to those found in arteries, but not so severe. Preliminary training is shown to raise tolerance to the effects of subsequent stresses. The effects of immobility, strenuous exercise, and radiation on animals are studied with regard to the development of lymph collaterals. Author

N73-32002*# Techtran Corp., Glen Burnie, Md.
INTERNAL CEREBRAL "SET POINT" TEMPERATURE MODEL IN WARM-BLOODED ANIMALS
Juliusz Narebski Washington NASA Oct. 1973 16 p refs Transl. into ENGLISH from Acta Physiol. Pol. (Poland), v. 24, no. 3, suppl. 6, 1973 p 77-89
(Contract NASw-2485)
(NASA-TT-F-15138) Avail: NTIS $3.00 CSCL 06C

The possibility of the hypothalamus serving as a heat regulator for the entire body is adduced from physiological evidence and experimental factors. However, it is very clear that this is a hypothesis and not necessarily fact. Author

N73-32003*# Kanner (Leo) Associates, Redwood City, Calif.
THERMOREGULATION DURING PHYSICAL EXERCISES OF MEN WITH DIVERSE PHYSICAL PERFORMANCE CAPACITIES
S. Kozlowski and J. Domaniecki Washington NASA Oct. 1973 17 p refs Transl. into ENGLISH from Acta Physiol. Polon. (Warsaw), v. 23, no. 5, 1972 p 761-772
(Contract NASw-2481)
(NASA-TT-F-15142) Avail: NTIS HC $3.00 CSCL 06S

Ten males with low physical performance capacity and 10 males with high physical performance capacity were measured during one hour work on a cycloergometer for rectal temperature, mean skin temperature, and oxygen intake. During the most strenuous work, the rectal temperature stabilized after 30-45 min. among subjects with good physical performance capacity, whereas it increased amoung subjects with a low physical performance capacity. After one hour the difference exceeded 0.5 C (p smaller than 0.001). No differences were confirmed in the amount and composition of the electrolyte sweat and in the mean temperature of the skin. Author

N73-32004*# Techtran Corp., Glen Burnie, Md.
DETERMINING OPTIMAL PERIODS OF BED REST BY CERTAIN PHYSIOLOGICAL INDICES
A. A. Mikhaylenko Washington NASA Oct. 1973 8 p Transl. into ENGLISH from Voyenno-Med. Zh. (Moscow), v. 7, 1970 p 34-37

(Contract NASw-2485)
(NASA-TT-F-15144) Avail: NTIS HC $3.00 CSCL 06P

A study of two groups of patients placed in a bed rest regime is reported, the first group being the control, the second group being the experiment. The control group, which was not permitted exercise, developed certain motor disorders and symptoms of vascular and emotional instability. The second group developed the same symptoms in spite of the exercise but at a later period. The development of symptoms in the experimental group is attributed to inadequately thorough regimes of exercise. Author

N73-32005*# Physiometrics, Inc., Malibu, Calif.
POSTPONEMENT OF INCIPIENT COLLAPSE DUE TO WORK-INDUCED HEAT STRESS BY LIMITED COOLING Final Report
W. Vincent Blockley Sep. 1973 33 p refs
(Contract NAS9-11889)
(NASA-CR-134059) Avail: NTIS HC $3.75 CSCL 06S

Four subjects completed five treadmill training sessions under comfortable to cool conditions and were calibrated to find an optimum combination of speed and grade on the treadmill which would produce a metabolic rate of 2000 Btu-hr. Dressed in an Apollo liquid cooling garment, each man underwent a total of four experiments in which the rate of heat extraction from the liquid cooling garment was adjusted to an amount which would cause a storage within the body of 1000 Btu/hr. Physiological measurements included skin temperature at 9 locations, rectal and ear canal probes, and heart rate. The increases in tolerance time for the various subjects and the various methods of emergency cooling, ranged from a low of six minutes to a high of 48 minutes, or from 8 to 102% of the baseline tolerance times. The largest gains were achieved in a subject whose tolerance endpoint was atypical, and whose baseline heat tolerance was unsually low. Author

N73-32006*# Scientific Translation Service, Santa Barbara, Calif.
VIRUCIDAL ACTION OF HYDROGEN PEROXIDE AEROSOLS IN DECONTAMINATION OF AIR IN AN INFLUENZA NIDUS
B. P. Fedyayev, K. M. Florensova, V. V. Sidenko, and Z. I. Stepanova Washington NASA Oct. 1973 12 p refs Transl. into ENGLISH from Zh. Mikrobiol. Epidemiol. Immunobiol. (Moscow), no. 9, 1972 p 137-142
(Contract NASw-2483)
(NASA-TT-F-15127) Avail: NTIS HC $3.00 CSCL 06E

Hydrogen peroxide aerosols were used for decontamination of the atmosphere in premises of an influenza epidemic nidus. The work was carried out in a children's institution during the influenza outbreak. Influenza virus, type A sub 2 was isolated from 12 out of 27 air samples tested before the disinfection. A distinct virucidal effect followed a single application of hydrogen peroxide aerosols. In the premises which were only ventilated the influenza virus of the same type was isolated in 6 air samples taken in the course of one day. The use of hydrogen peroxide aerosol is the most expedient for decontamination of the atmosphere in premises in which human beings stay for short periods of time. Author

N73-32007*# National Aeronautics and Space Administration, Washington, D.C.
BIOMEDICINE: A COMPILATION
[1973] 32 p
(NASA-SP-5958(01)) Avail: NTIS HC $1.00 CSCL 06D

Developments in NASA technology of possible interest to outside users are reported. Complied are descriptions of a number of instruments that have proven useful in monitoring and treating patients. Described are several diagnostic, prosthetic, and therapeutic devices as well as patent information on new innovations in aerospace medicine technology. G.G.

N73-32008*# Harding Coll., Searcy, Ark.
AN EVALUATION OF THE EFFECTS OF BED REST, SLEEP DEPRIVATION AND DISCONTINUANCE OF TRAINING ON THE PHYSICAL FITNESS OF HIGHLY TRAINED YOUNG MEN Progress Report, 1 Sep. 1972 - 31 Aug. 1973
Harry D. Olree, Bob Corbin, Gene Dugger, and Carroll Smith 31 Aug. 1973 46 p refs
(Contract NAS9-9433)
(NASA-CR-134044) Avail: NTIS HC $4.50 CSCL 06S

This experiment was conducted to determine what physiological effects result when highly trained subjects are confined to bed, deprived of sleep, or allowed to discontinue training. Results indicated: (1) There was a moderate increase in strength variables due to the training in this experiment but the stress which the subjects received caused a negligible change in strength variables. (2) The training program resulted in highly significant changes in specific bicycle ergometer variables indicating good increases in cardiopulmonary fitness. Five days of bed rest or fifty hours of sleep deprivation caused comparable drastic decreases in cardiopulmonary fitness. Post stress the subjects reverted to a normal daily schedule and after two weeks they had recovered about half of what they lost. (3) Cardiac output remains relatively constant at a constant work load, but stroke volume increases with conditioning and decreases with deconditioning due to stress. Author

N73-32009*# Stanford Research Inst., Menlo Park, Calif.
MACROMOLECULAR FRACTIONATION AND DETERMINATION Final Quarterly Report
Fu-Chuan Chao Jul. 1973 28 p refs
(Contract NAS2-5754; SRI Proj. LSU-8430)
(NASA-CR-114673; QR-13) Avail: NTIS HC $3.50 CSCL 06M

Biological materials were recovered from other materials ultracentrifugation techniques. Data cover fatty acid synthetase, acetyl-CoA synthetase, ribosomes, DNA, RNA, and AMP. E.H.W.

N73-32010# Naval Medical Research Inst., Bethesda, Md.
THE NMRI MARK 3 MOD 1 TREMOR DEVICE Medical Research Progress Report no. 2
George J. Tresansky May 1973 23 p refs
(AD-763343) Avail: NTIS CSCL 06/19

A muscle force transducer was developed as a research tool to detect and quantify tremors in divers working under hyperbaric conditions. The tremor device measures microtremor superimposed upon a neuromuscular response maintained within a specific force band. It incorporates a simple motor skill task, which requires the diver subject to maintain, for a predetermined number of seconds, a constant downward pressure with the tip of the middle finger upon a lever which is preset to a specific force. Variations in the subject's ability to maintain the zero reading are considered tremor. Measurement of tremor against an established baseline of an individual diver can provide an indication of neurological change, which may interfere with underwater work performance. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-32011* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC INSTRUMENT FOR CHEMICAL PROCESSING TO DETECT MICROORGANISM IN BIOLOGICAL SAMPLES BY MEASURING LIGHT REACTIONS Patent
Burton N. Kelbaugh, Grace L. Picciolo, Emmett W. Chappelle, and Maurice E. Colburn, inventors (to NASA) Issued 4 Sep. 1973 16 p Filed 30 Apr. 1971 Supersedes N71-34079 (09 - 21, p 3385) Continuation-in-part of abandoned US Patent Appl. SN-60882, filed 4 Aug. 1970
(NASA-Case-GSC-11169-2; US-Patent-3,756,920; US-Patent-Appl-SN-139094; US-Patent-Class-195-127; US-Patent-Appl-SN-60882) Avail: US Patent Office CSCL 06B

An automated apparatus is reported for sequentially assaying urine samples for the presence of bacterial adenosine triphosphate (ATP) that comprises a rotary table which carries a plurality of sample containing vials and automatically dispenses fluid reagents

into the vials preparatory to injecting a light producing luciferase-luciferin mixture into the samples. The device automatically measures the light produced in each urine sample by a bioluminescence reaction of the free bacterial adenosine triphosphate with the luciferase-luciferin mixture. The light measured is proportional to the concentration of bacterial adenosine triphosphate which, in turn, is proportional to the number of bacteria present in the respective urine sample.
Official Gazette of the U.S. Patent Office

N73-32012* International Latex Corp., Dover, Del.
SPACE SUIT Patent
Leonard F. Shepard, George P. Durney, Melvin C. Case, A. J. Kenneway, III, Robert C. Wise, Dixie Rinehart, Ronald J. Bessette, and Richard C. Pulling, inventors (to NASA) Issued 14 Aug. 1973 21 p Filed 5 Aug. 1968 Sponsored by NASA
(NASA-Case-MSC-12609-1; US-Patent-3,751,727;
US-Patent-Appl-SN-750031; US-Patent-Class-2-2.1A;
US-Patent-Class-2-81; US-Patent-Class-128-1A) Avail: US Patent Office CSCL 06Q

A pressure suit for high altitude flights, particularly space missions is reported. The suit is designed for astronauts in the Apollo space program and may be worn both inside and outside a space vehicle, as well as on the lunar surface. It comprises an integrated assembly .of inner comfort liner, intermediate pressure garment, and outer thermal protective garment with removable helmet, and gloves. The pressure garment comprises an inner convoluted sealing bladder and outer fabric restraint to which are attached a plurality of cable restraint assemblies. It provides versitility in combination with improved sealing and increased mobility for internal pressures suitable for life support in the near vacuum of outer space.
Official Gazette of the U.S. Patent Office

N73-32013* North American Rockwell Corp., Los Angeles, Calif.
TACTILE SENSING MEANS FOR PROSTHETIC LIMBS Patent
Walter L. Scott, inventor (to NASA) Issued 14 Aug. 1973 5 p Filed 22 Feb. 1972 Supersedes N72-20111 (10 - 11, p 1433) Sponsored by NASA
(NASA-Case-MFS-16570-1; US-Patent-3,751,733;
US-Patent-Appl-SN-228150; US-Patent-Class-3-1.1;
US-Patent-Class-3-2; US-Patent-Class-3-6;
US-Patent-Class-3-12) Avail: US Patent Office CSCL 06B

An improved prosthetic device characterized by a frame and a socket for mounting on the stump of a truncated human appendage is described. Flexible digits extend from the distal end and transducers located within the digits act as sensing devices for detecting tactile stimuli. The transducers are connected through a power circuit with a slave unit supported by a strap and fixed to the stump. The tactile stimuli detected at the sensing devices are reproduced and applied to the skin of the appendage in order to stimulate the sensory organs located therein. Official Gazette of the U.S. Patent Office

N73-32014* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FOOT PEDAL OPERATED FLUID TYPE EXERCISING DEVICE Patent
Gerald W. Crum and Richard J. Sauter, inventors (to NASA) Issued 11 Sep. 1973 6 p Filed 26 May 1971 Supersedes N72-11087 (10 - 02, p 0159)
(NASA-Case-MSC-11561-1; US-Patent-3,758,112;
US-Patent-Appl-SN-146940; US-Patent-Class-272-79C;
US-Patent-Class-272-DIG.5; US-Patent-Class-272-DIG.1;
US-Patent-Class-272-DIG.4; US-Patent-Class-137-535;
US-Patent-Class-91-186) Avail: US Patent Office CSCL 05E

A foot pedal operated exercising device is reported that contains a dynamometer formed of a pair of cylinders each containing a piston. The pistons are linked to each other. The upper portions of the two cylinders are joined together by a common opening to provide a common fluid reservoir and each piston is provided with a one way check valve to maintain an adequate supply of working fluid. Fluid from the driven cylinder is transmitted to the other cylinder through separate constant force spring biased valves each valve takes the predominant portion of the pressure drop thereby providing a constant force hydraulic dynamometer. A device is provided to determine the amount of movement of piston travel.
Official Gazette of the U.S. Patent Office

N73-32015* Quantum Dynamics, Tarzana, Calif.
RESPIRATORY ANALYSIS SYSTEM AND METHOD Patent
Frederick F. Liu, inventor (to NASA) Issued 18 Sep. 1973 7 p Filed 19 Aug. 1971 Supersedes N72-20113 (10 - 11, p 1433) Sponsored by NASA
(NASA-Case-MSC-13436-1; US-Patent-3,759,249;
US-Patent-Appl-SN-173190; US-Patent-Class-128-2.08;
US-Patent-Class-73-194E; US-Patent-Class-73-194M;
US-Patent-Class-128-2.07) Avail: US Patent Office CSCL 06B

A system is described for monitoring the respiratory process in which the gas flow rate and the frequency of respiration and expiration cycles can be determined on a real time basis. A face mask is provided with one-way inlet and outlet valves where the gas flow is through independent flowmeters and through a mass spectrometer. The opening and closing of a valve operates an electrical switch, and the combination of the two switches produces a low frequency electrical signal of the respiratory inhalation and exhalation cycles. During the time a switch is operated, the corresponsing flowmeter produces electric pulses representative of the flow rate; the electrical pulses being at a higher frequency than that of the breathing cycle and combined with the low frequency signal. The high frequency pulses are supplied to conventional analyzer computer which also receives temperature and pressure inputs and computes mass flow rate and totalized mass flow of gas. From the mass spectrometer, components of the gas are separately computed as to flow rate. The electrical switches cause operation of up-down inputs of a reversible counter. The respective up and down cycles can be individually monitored and combined for various respiratory measurements. Official Gazette of the U.S. Patent Office

N73-32016*# Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF THE ARTERIAL PRESSURE BY THE TACHOOSCILLOSCOPE METHOD AFTER N. N. SAVITSKIY
Washington NASA Sep. 1973 5 p Transl. into ENGLISH of Rept. "Izmereniye Arterialnogo Davleniya Takhoostsillograficheskim metodom po N. N. Savitskomu" Moscow, Acad. Sci. USSR, 1973 3 p
(Contract NASw-2481)
(NASA-TT-F-15088) Avail: NTIS HC $3.00 CSCL 06B

The tachooscillographic method is described as an oscillometric method that uses a differential manometer to determine the first derivative (rate curve) of the change of the volume of the vessel beneath the collar. It is not the height of the oscillation which is informative, but rather the nature of the deformation of the lower (diastolic) portion of the curve. Author

N73-32017*# Kanner (Leo) Associates, Redwood City, Calif.
CONTRIBUTION TO THE STUDY OF FACTORS CONTROLLING THE RATE OF SUMMATION OF LUMINOUS IMPRESSIONS FROM UNEQUAL SURFACES (RETINAL HETEROGENEITY)
N. Kleitman and H. Pieron Washington NASA Oct. 1973 37 p refs Transl. into ENGLISH from Annee Psychologique (France), v. 29, 1928 p 57-91
(Contract NASw-2481)
(NASA-TT-F-15124) Avail: NTIS HC $4.00 CSCL 05E

The influence is presented of the excitation surface with liminal brightness, for luminous perception and for chromatic perception, using white light or monochromatic lights in dark and in light adaptation, on the level of different regions of the retina. The retina's constitutive heterogeneity its duality of receptor elements, the unequal sensibility of these elements distributed over its entire surface, their unequal concentration on optic fibers and the unequal optic insulation of the elements and the unequal nervous insulation of the neurons are reported. The influence of the luminous excitation surface cannot be covered by a simple law, at least if we leave aside the small foveal region (with an aperture of about 1/2 deg) where there exist only cones that are individually connected to the central neurons. Author

N73-32018*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
PAYLOAD CARRIER SIMULATOR MAN/SYSTEMS PROGRAM INTEGRATION, VOLUME 2, PHASE A Final Report
Jon G. Rogers and Robert E. James Jul. 1973 173 p 2 Vol.
(Contract NAS8-28512)
(NASA-CR-124430) Avail: NTIS HC $10.75 CSCL 05H

A man/systems assessment plan is outlined that considers the various habitability parameters in order to verify design concepts for future shuttle-type manned space missions. A payload carrier simulation study is used to collect data on: crew productivity, crew state, and habitat design effecticiency. Statistical and experimental analyses are used to compare the various mission data with each other. G.G.

N73-32019# Joint Publications Research Service, Arlington, Va.
IDEATION AND AUTOMATION
D. A. Pospelov and V. N. Pushkin 24 Sep. 1973 185 p refs Transl. into ENGLISH of the book "Myshleniye i Avtomaty" Moscow, Izdatel'stvo Sovetskoye Radio, 17 Feb. 1972 224 p
(JPRS-60103) Avail: NTIS HC $11.25 CSCL 05E

An analysis is reported of the process of solving problems arising when controlling large systems. The results of experimental research on intuition, conducted using new objective methods, are submitted. A psychological concept is formulated that permits the planning of development of new methods of programming in cybernetics, and means of developing devices capable of controlling large systems of these methods is described. Author

N73-32020*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ENVIRONMENT SANITATION HANDBOOK
17 Aug. 1973 48 p refs
(NASA-TM-X-69522; KHB-1870.1/IS) Avail: NTIS HC $4.50 CSCL 06I

The environmental Sanitation handbook provides guidance in the implementation of the basic provisions of occupational medicine and environmental health programs to environmental sanitation. It presents methods and procedures useful for the control of those sanitation factors which could create discomfort and illness in man or do harm to his environment. The provisions of this handbook are applicable to all organizational elements of the Kennedy Space Center (KSC),NASA, and to its associated contractors located at KSC in accordance with the terms of their respective contracts. Author

N73-32021*# Hamilton Standard, Windsor Locks, Conn.
CENTRAL WASTE PROCESSING SYSTEM
Frank L. Kester Jun. 1973 128 p refs
(Contract NAS9-12730)
(NASA-CR-134048; SVHSER-6224) Avail: NTIS HC $8.50 CSCL 06I

A new concept for processing spacecraft type wastes has been evaluated. The feasibility of reacting various waste materials with steam at temperatures of 538 - 760 C in both a continuous and batch reactor with residence times from 3 to 60 seconds has been established. Essentially complete gasification is achieved. Product gases are primarily hydrogen, carbon dioxide, methane, and carbon monoxide. Water soluble synthetic wastes are readily processed in a continuous tubular reactor at concentrations up to 20 weight percent. The batch reactor is able to process wet and dry wastes at steam to waste weight ratios from 2 to 20. Feces, urine, and synthetic wastes have been successfully processed in the batch reactor. Author

N73-32022*# McDonnell-Douglas Corp., St. Louis, Mo.
THE COMPUTERIZED ANATOMICAL MAN (CAM) MODEL Summary Final Report
M. P. Billings and W. R. Yucker Sep. 1973 160 p refs
(Contract NAS9-13228)
(NASA-CR-134043; MDC-G4655) Avail: NTIS HC $10.00 CSCL 05E

A computerized anatomical man (CAM) model, representing the most detailed and anatomically correct geometrical model of the human body yet prepared, has been developed for use in analyzing radiation dose distribution in man. This model of a 50-percentile standing USAF man comprises some 1100 unique geometric surfaces and some 2450 solid regions. Internal body geometry such as organs, voids, bones, and bone marrow are explicitly modeled. A computer program called CAMERA has also been developed for performing analyses with the model. Such analyses include tracing rays through the CAM geometry, placing results on magnetic tape in various forms, collapsing areal density data from ray tracing information to areal density distributions, preparing cross section views, etc. Numerous computer drawn cross sections through the CAM model are presented. Author

N73-32023*# Harding Coll., Searcy, Ark.
AN EVALUATION OF THE EXER-GENIE EXERCISER AND THE COLLINS PEDAL MODE ERGOMETER FOR DEVELOPING PHYSICAL FITNESS Final Progress Report, 1 May 1969 - 31 Aug. 1973
Harry D. Olree 31 Aug. 1973 7 p
(Contract NAS9-9433)
(NASA-CR-134046) Avail: NTIS HC $3.00 CSCL 06D

Experiments that were conducted over a 52-month period showed that isometric and isotonic training on the Exer-Genie gave negligible increases in cardiorespiratory fitness whereas training on the ergometer at a programmed pulse rate increased fitness moderately. Author

N73-32024# Army Research Inst. for the Behavioral and Social Sciences, Arlington, Va.
EFFECT OF PHOTO DEGRADATION ON INTERPRETER PERFORMANCE
Thomas E. Jeffrey Jun. 1973 49 p
(DA Proj. 2Q6-62704-A-721)
(AD-763908; ARI-TRN-245) Avail: NTIS CSCL 05/10

Scale, haze, and image motion are judged to be the key factors in determining the interpretability of photographs encountered operationally, and images varying in these factors were produced by manipulating operational imagery in the laboratory. Image interpreters were given tasks of detecting and identifying military targets on these images. Their scores were used to assess interpretability as a function of scale, haze, and image motion. When considered singly, scale, haze, and image motion had little effect on interpreter target detection performance. When two or more of these sources of degradation were present simultaneously, target detection performance deteriorated markedly. In general, the decrease in target detection accuracy obtained with increased photo degradation appears to be due more to erroneous classification of non-targets as targets than to the misclassification of targets as non-targets. Target identification accuracy and completeness were significantly reduced by either unidimensional or multidimensional degrading conditions of the type used in this experiment. When photographic scale was small, the effect of other sources of degradation on interpreter performance was significantly greater than when photographic scale was large. (Modified author abstract) GRA

N73-32025# Illinois Univ., Savoy. Aviation Research Lab.
A PARAMETRIC STUDY OF PILOT PERFORMANCE WITH MODIFIED AIRCRAFT CONTROL DYNAMICS, VARYING NAVIGATIONAL TASK COMPLEXITY, AND INDUCED STRESS Ph.D. Thesis
Emmett Francis Kraus May 1973 116 p refs
(Contract F44620-70-C-0105; DOT-FA71WA-2574; AF Proj. 9778)
(AD-764760; ARL-73-10/AFOSR-73-6/FAA-73-3) Avail: NTIS CSCL 01/3

Experiments were conducted in a Link GAT-2 to evaluate the effectiveness of a system providing direct control over aircraft maneuvering performance. Pilots performed complex navigational tasks involving the use of a computer-assisted area navigation system. Changing waypoint storage capacity of the simulated navigation system induced variable task loading on subjects. The experiment was replicated with and without a self-adaptive side task to determine levels of residual attention associated with the control modifications and the varying workload levels. The flight performance controller yielded greater precision of maneuvering control, fewer procedural blunders, and an increased level of residual pilot attention. The side task proved to be a reliable discriminator of changes in workload associated with small changes in system design and task complexity. Author (GRA)

N73-32026# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PILOT PARAMETER IDENTIFICATION VIA THE EXTENDED KALMAN FILTER M.S. Thesis
Stephen A. Walker Jun. 1973 128 p refs
(AD-764694; GGC/MA/73-5) Avail: NTIS CSCL 05/9

The extended Kalman filter was used to estimate three pilot parameters, a pilot gain, lead time constant, and pure time delay. These parameters were estimated by defining them as states in an augmented state vector. The pilot model used consisted of a pilot gain, first order lead, and a Pade approximation of the pure time delay. The aircraft model consisted of the longitudinal short period equations plus a wind gust term. The accuracy of the estimated pilot parameters was determined by numerically comparing the true and estimated parameters and by model matching, that is, by comparing the transient responses of the pilot aircraft model containing the estimated pilot parameters with the pilot-aircraft model containing the true values of the parameters. (Modified author abstract) GRA

N73-32027# Human Resources Research Organization, Alexandria, Va.
COMBAT JOB REQUIREMENTS FOR THE AIR CAVALRY AEROSCOUT PILOT AND AEROSCOUT OBSERVER
William L. Warnick Dec. 1972 72 p refs
(Contract DAHC19-73-C-0004; DA Proj. 2Q0-62107-A-745)
(AD-755505; HUMRRO-TR-72-37) Avail: NTIS CSCL 05/9

The objectives of the research were to formulate and describe the skills and knowledges required for combat job performance for the aeroscout pilot and aeroscout observer in an Air Cavalry Unit, and to determine how much emphasis should be placed on each skill or knowledge area during training. Job inventory lists were administered to 14 combat-experienced aeroscout pilots and 15 aeroscout observers. The respondents judged each skill or knowledge item in terms of its importance for job performance in combats. This information provides a basis for organizing content and subject emphasis of formal training programs, and provides school personnel and field commanders with a basis for evaluation and development of such. Author

N73-32028# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF VARIOUS TYPES OF FAILURES OF A HUMAN OPERATOR ON THE EFFECTIVENESS OF HIS WORK
A. I. Gubinskii 27 Jul. 1973 15 p refs Transl. into ENGLISH from the book "Psikhologiya v Priborostr., Sb. Inzh." USSR, 1967 p 139-144
(AD-764937; FTD-HT-23-695-73) Avail: NTIS CSCL 05/8

An examination is made of the effect of the various types of a human operator's errors on the reliability and efficiency of his work. GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-32029* Rocketdyne, Canoga Park, Calif.
NOVEL POLYMERS AND METHOD OF PREPARING SAME Patent
Stanley M. Hirshfield, inventor (to NASA) Issued 28 Aug. 1973 6 p Filed 19 May 1971 • Supersedes N72-15127 (10 - 06, p 0731) Sponsored by NASA
(NASA-Case-NPO-10998-1; NASA-Case-NPO-10999-1; US-Patent-3,755,283; US-Patent-Appl-SN-145027; US-Patent-Class-260-93.5S; US-Patent-Class-252-431R; US-Patent-Class-252-431N; US-Patent-Class-260-47UP; US-Patent-Class-260-93.5A; US-Patent-Class-260-94.2R; US-Patent-Class-260-94.2M; US-Patent-Class-260-94.7R; US-Patent-Class-260-567.6M) Avail: US Patent Office CSCL 07D

Polymers are prepared with terminal functional groups by reacting a compound selected from the group consisting of lithium p-lithiophenoxide and tetrabutylammonium p-lithiophenoxide as an initiator with material such as butadiene. The resulting functionally terminated new polymers are then capable of reacting with coupling agents to form star polymers.
Official Gazette of the U.S. Patent Office

N73-32030* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POLYMERIZABLE DISILANOLS HAVING IN-CHAIN PERFLUOROALKYL GROUPS Patent
William J. Patterson and Donald E. Morris, inventors (to NASA) Issued 2 Oct. 1973 3 p Filed 20 Jan. 1972 Supersedes N72-21101 (10 - 12, p 1566) Continuation-in-part of US Patent Appl. SN-100774, filed 22 Dec. 1970
(NASA-Case-MFS-20979-2; US-Patent-3,763,204; US-Patent-Appl-SN-219590; US-Patent-Class-260-448.2D; US-Patent-Appl-SN-100774) Avail: US Patent Office CSCL 07C

Disilanols containing in-chain perfluoroalkyl and aromatic groups and the process by which they were prepared are discussed. The disilanols, when reacted with a diaminosilane and cured, produce polymeric material resistant to hydrocarbon fuels and stable at elevated temperatures.
Official Gazette of the U.S. Patent Office

N73-32031*# North Carolina State Univ., Raleigh. School of Engineering.
EQUILIBRIUM CONCENTRATIONS OF N2H4 AND ITS DECOMPOSITION PRODUCTS AT ELEVATED TEMPERATURES AND PRESSURES
Frederick O. Smetana, Howard N. Fairchild, III, and Glenn L. Martin [1973] 78 p refs
(Contract NASw-2490)
(NASA-CR-135478) Avail: NTIS HC $6.00 CSCL 07D

Liquid hydrazine is considered as a convenient source of hydrogen rather than just as a rocket fuel. For such purposes, the hydrogen is usually obtained by passing the hydrazine through a heated catalytic bed. One convenient measure of the effectiveness of a catalytic decomposition device as a whole is to compare the quantity of hydrogen produced with the equilibrium concentration of the gaseous species N2H4, NH3, N3, and H2 which would exist at the temperature and pressure found in various parts of the device. Calculations of the concentrations were carried out and are reported here. Following presentation of the results in both tabular and graphical forms is a comparison between the computed equilibrium concentrations and available experimental data. Author

N73-32032*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLUTE DIFFUSION IN LIQUID METALS
B. N. Bhat Washington Oct. 1973 18 p refs
(NASA-TR-R-417; M-701) Avail: NTIS HC $2.75 CSCL 07D

A gas model of diffusion in liquid metals is presented. In this model, ions of liquid metals are assumed to behave like the molecules in a dense gas. Diffusion coefficient of solute is discussed with reference to its mass, ionic size, and pair potential. The model is applied to the case of solute diffusion in liquid silver. An attempt was made to predict diffusion coefficients of solutes with reasonable accuracy. Author

N73-32033*# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF THE REACTIVITY OF AMINO ACIDS AND CARBOXYLIC ACIDS IN AQUEOUS MEDIUM BY AN ISOTOPE LABELING METHOD. 1: A STUDY OF THE REACTION OF ALPHA-AMINO ACIDS WITH METHYL RADICALS BY MEANS OF DEUTERATED ALPHA-AMINO ACIDS
G. Moger, Gy. Mink, I. Nemes, A. Cserhegyi, and D. Moger Washington NASA Oct. 1973 17 p refs Transl. into ENGLISH from Magy. Kem. Folyoirat (Budapest), v. 78, no. 9, 1972 p 491-496
(Contract NASw-2481)
(NASA-TT-F-15123) Avail: NTIS HC $3.00 CSCL 07C

In the reaction of methyl radicals in aqueous solution with partially deuterated alpha-alanine and glycine, the kinetic isotope effect of deuterium in the alpha-position has been studied. The investigations were based on the determination of the deuterium content of the methane formed in the reactions. For this reason,

the reactions were carried out under such conditions that methane was formed exclusive of hydrogen (deuterium) abstraction from the alpha-carbon atoms. For alpha-alanine and glycine, the kinetic isotope effects determined by this method were 6.6 and 11.4 respectively. Author

N73-32034*# Scientific Translation Service, Santa Barbara, Calif.
ROLE OF FULVIC ACIDS DURING THE WEATHERING OF SILICATE MINERALS
Ye. I. Sokolova Washington NASA Oct. 1973 12 p Transl. into ENGLISH from the book "Materialy Seminarii: Geokhimiya Gipergeneza Kory Vyvetrivaniya" Minsk, Izd. Akad. Nauk BSSR, 1969 p 162-171
(Contract NASw-2483)
(NASA-TT-F-15134) Avail: NTIS HC $3.00 CSCL 07D

The processes of migration and accumulation of aluminum in different crusts produced from weathering are studied by analyzing the decomposition conditions of silicate minerals by humic soil acids. Author

N73-32035*# Scientific Translation Service, Santa Barbara, Calif.
ROLE OF THE TEMPERATURE FACTOR DURING THE WEATHERING OF MINERALS
L. A. Matveyeva and K. I. Lukashev, ed. Washington NASA Oct. 1973 8 p Transl. into ENGLISH from Reports of the Geochemistry of the Hypergenesis of Crustal Weathering Seminar (Belorussian SSR), 1969 p 133-138
(Contract NASw-2483)
(NASA-TT-F-15135) Avail: NTIS HC $3.00 CSCL 07D

Mineral weathering was studied on the example of biotite and nepheline decomposition at atm. pressure between 45 and 70 deg. Reagents used were H2O, H2O-sol. humic acids, oxalic acid, and, for comparison, 0.005N H2SO4. Different results were obtained for biotite and nepheline. Author

N73-32036# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE SHOCK TUBE DECOMPOSITION OF PROPYLENE
Alexander Burcat [1973] 27 p refs
(TAE-172) Avail: NTIS HC $3.50

The high temperature decomposition of propylene was investigated in a single pulse shock tube. The stable products checked were H2, CH4, C2H2, C2H4, C2H6, allene and propyne. The decomposition rate of propylene in the temperature range 1160-1700 K was found. The rate of appearance of the products was found to have similar concentration dependencies except for ethane, that was found to be dependent only on the third body concentration. The forwarded kinetic scheme explains this anomality. Author

N73-32037# Ulm Univ. (West Germany). Abteilung fuer Physikalische Chemie.
A PROCESSOR CONTROLLED MICROWAVE SPECTROMETER FOR TRACE DETECTION [EIN MICROWELLENSPEKTROMETER MIT PROZESSRECHNERSTEUERUNG ZUM SPURENNACHWEIS]
B. Haas, R. Gegenheimer, K. H. Peting, and W. Zeil Bonn Bundeswehramt 1973 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-18) Avail: NTIS HC $4.75; Bundeswehramt 25 DM

The sensitivity of a microwave spectrometer is discussed and a description of a new computer controlled Stark spectrometer is given. A time averaging method was used to improve the spectrometer sensitivity. The digitally recorded spectra are stored in a memory core and can be processed by on-line data reduction, thus obtaining a better frequency determination. Using this method, the notational line corresponding to J=0 yields 1, F=3/2 yields 5/2 of the isotopic species 180 12C 33S with an unsaturated adsorption coefficient of 1.3 x 10 to the minus 10th power/cm in natural abundance was measured. ESRO

N73-32038# National Environmental Research Center, Research Triangle Park, N.C. Chemistry and Physics Lab.
WORKSHOP ON MATHEMATICAL MODELING OF PHOTOCHEMICAL SMOG: SUMMARY OF THE PROCEEDINGS
Marcia C. Dodge Jan. 1973 55 p Conf. held 30-31 Oct. 1972
(PB-221177/9; EPA-R4-73-010) Avail: NTIS HC $3.00 CSCL 07E

A workshop on modeling of photochemical smog was held for two main reasons. One purpose was to establish lines of communication between the person gathering the data and the person who is using the data to formulate a photochemical model. The second purpose was to determine those key areas where further research is needed. The papers and discussions presented during the workshop may be classified under the following subject areas: the role of kinetic studies in modeling, the role of smog chamber experiments in modeling, and the role of atmospheric measurements in modeling. GRA

N73-32039# GTE Labs., Inc., Waltham, Mass.
LITHIUM ANODE CELLS OPERATING AT ROOM TEMPERATURE IN INORGANIC ELECTROLYTIC SOLUTIONS Final Report
James J. Auborn, Kenneth W. French, Sheldon I. Lieberman, Vinod K. Shah, and Adam Sheller 1 Jun. 1973 35 p refs Submitted for publication
(Contract N00014-71-C-0328)
(AD-763478; TR-73-844.1) Avail: NTIS CSCL 07/4

Lithium anode electrochemical cells have been operated at room temperature using electrolytic solutions of lithium salts in inorganic solvents such as phosphorus oxychloride, thionyl chloride and sulfuryl chloride. Lithium metal can be electrodeposited from these solutions accompanied, in the case of chlorine containing electrolytes, by the simultaneous electrogeneration of chlorine at the positive electrode. The resulting lithium/chlorine electrochemical cells have open circuit potentials of 4.0 to 4.3V, depending on the presence of excess Lewis acid in the electrolyte. The solvents are compatible with both lithium metal and with strong oxidants including chlorine (Cl2), cupric acid (CuF2), polycarbon monofluoride (CF)n, and tungsten trioxide (WO3) which can be used as cathode materials. The solvents themselves, while difficult to oxidize, can be electrochemically reduced at various catalytic surfaces (such as carbon black and metals) and act as cathode depolarizers. This catalytic solvent reduction process leads to cells with exceptionally stable voltages and energy densities in excess of 500 Wh/kg. Author (GRA)

N73-32040# General Electric Co., Santa Barbara, Calif. DASIAC.
REACTION RATE DATA, NO. 39
Apr. 1973 34 p refs
(Contract DNA001-73-C-0019)
(AD-764647) Avail: NTIS CSCL 07/4

The report presents summaries of recent progress reports and other informal information of current interest in the reaction rate field. Most of the reports concern upper atmospheric chemistry, atomic, molecular, and ionic reactions, or reactions of interest to nuclear fireball studies. GRA

N73-32041# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NO. 40, MAY 1973
May 1973 40 p refs
(Contract DNA001-73-C-0019)
(AD-764892) Avail: NTIS CSCL 07/4

The report presents summaries of recent progress reports and other informal information of current interest in the reaction rate field. Most of the reports concern upper atmosphere chemistry or reactions of interest to nuclear fireball studies. GRA

N73-32042# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
EXCITATION OF HIGH VIBRATIONAL STATES OF N2 AND CO VIA SHAPE RESONANCES Annual Report
M. J. W. Boness and G. J. Schulz 1 Jul. 1973 21 p refs
(Contract N00014-67-A-0097-0025)
(AD-764596) Avail: NTIS CSCL 07/4

The vibrational cross section to v = 8, 9 and 10 by electron impact on N2 and CO has been measured in the energy range 2 - 4 eV. In this energy range, vibrational excitation proceeds predominantly via a compound state and decay into high vibrational states can occur. At the first peak, the ratio of cross

sections for v = 8 : 9 : 10 is 1 : 0.31 : 0.11 in N2, and 1 : 0.51 : 0.25 in CO. These ratios are largely determined by the quantum mechanical penetration through the centifugal barrier. Author (GRA)

N73-32043# Air Force Human Resources Lab., Wright-Patterson AFB, Ohio. School of Engineering.
DETERMINATION OF STABLE ELEMENTS IN AIR POLLUTION PARTICULATES BY NEUTRON ACTIVATION ANALYSIS M.S. Thesis
Jimmy A. Richardson Jun. 1973 116 p refs
(AD-764715; GNE/PH/73-4) Avail: NTIS CSCL 07/4

Neutron activation analysis was used to determine the quantities of 13 elements in samples of atmospheric particulate matter. Quantities ranged from 0.35 micrograms of Se to 34 milligrams of Ca, which were 0.0002% to 15% of the samples by weight. Twelve other elements were identified, but not quantified. An 80-cu cm lithium-drifted germanium detector with a resolution of 2.2 keV (FWHM) at 1.33 MeV and a 4096-channel analyzer were used for detection and counting of gamma radiation. Data were analyzed by SAMPO, a CDC 6600 computer program; details on the use of SAMPO are included. Techniques and methods of sample collection, sample preparation in quartz and polyethylene ampoules, and data reduction are reported. (Modified author abstract) GRA

N73-32044# Columbia Univ., New York.
GAS-PHASE OXIDATION OF ALUMINUM ATOMS Final Report, 1 May 1972 - 30 Apr. 1973
Richard N. Zare 30 Apr. 1973 9 p refs
(Grant DA-ARO(D)-31-124-72-G174; ARPA Order 1482)
(AD-765347) Avail: NTIS CSCL 07/4

The report very briefly discusses the author's research on the chemiluminescent reaction Al + O3 yielding AlO* + O2. Also developed was a new technique for detecting reaction products using laser-induced fluorescence which was applied to study the ground state BaO molecules formed in the reaction Ba + O2 to BaO + O. GRA

N73-32841* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A METHOD FOR ESTIMATING BOTH THE SOLUBILITY PARAMETERS AND MOLAR VOLUMES OF LIQUIDS
R. F. Fedors *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 45-53 refs (For availability see N73-32836 23-34) CSCL 07D

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-32045 British Broadcasting Corp., Kingswood (England). Research Dept.
THE AUTOMATIC PLOTTING OF AERIAL RADIATION PATTERNS
G. H. Millard and N. F. Spring Aug. 1973 11 p refs
(BBC-RD-1973/18; RA-114) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The presentation of aerial radiation patterns in the form of contour plots is described and a brief account is given of the plotting algorithm. Author

N73-32046 Missouri Univ., Rolla.
PERFORMANCE OF SELF BIT SYNCHRONIZERS FOR BINARY OVERLAPPING SIGNALS Ph.D. Thesis.
Chung-Tao David Wang 1972 143 p
Avail: Univ. Microfilms Order No. 73-17079

The optimum and suboptimum ways of providing self bit synchronization for binary overlapping signals are considered. A maximum likelihood synchronizer is derived as the optimum approach. The suboptimum ways are those employing decision directed feedback and matched derivative filter techniques which are proposed for treating the over-lapping signals. Combining the two suboptimum techniques along with the bandlimited version of the overlapping signal, a suboptimum synchronizer is derived. The performance of the above synchronizer is evaluated by Monte Carlo simulation techniques. Finally, a bit synchronizer using nonlinear filtering theory is considered. Dissert. Abstr.

N73-32047 Florida Univ., Gainesville.
OPTICAL BEHAVIOR OF PECULIAR EXTRAGALACTIC RADIO SOURCES Ph.D. Thesis
Richard Lynn Hackney 1972 225 p
Avail: Univ. Microfilms Order No. 73-15501

Photographic monitoring of optical counterparts of extragalatic radio sources with a 30-inch reflector has resulted in the discovery of violent optical variability in a number of sources with quasi-stellar optical images and peculiar radio spectra. Intensive observation of the sources PKS 2345-16, NRAO 512, and OX 074 during 1970-71 disclosed major outbursts of similar form in each light curve, with a single instance of recurrence seen in NRAO 512 after a long period of quiescence following the initial flare. Observations of the notoriously variable peculiar object BL Lac disclosed an isolated optical flare in late 1971 that resembled in form the flares seen in the optically violent quasars. Dissert. Abstr.

N73-32048 Purdue Univ., Lafayette, Ind.
RADAR RESOLUTION ENCHANCEMENT AND TARGET SURFACE RECONSTRUCTION Ph.D. Thesis
Lewis Allen Thurman 1972 193 p
Avail: Univ. Microfilms Order No. 73-15877

An optimum resolution filter is derived that trades off detection and estimation performance for improved resolution. This is accomplished by using a minimization procedure in a Hilbert space involving Lagrange multipliers to obtain the transfer function of a filter that minimizes the equivalent width of the output signal subject to constraints on the detection noise-to-signal ratio and on the variance of the error of the estimate of the time of the occurrence of the output signal. The filter thus derived is an optimum one and requires that the amplitude spectrum of the complex enveloped of the transmitted waveform be symmetric about zero frequency. Dissert. Abstr.

N73-32049 Houston Univ., Tex.
ANALYSIS OF INTERSYMBOL INTERFERENCE IN FADING CHANNELS Ph.D. Thesis
Jorge Valerdi 1972 156 p
Avail: Univ. Microfilms Order No. 73-15707

Two procedures for the evaluation of the probability of error for binary receivers in the presence of intersymbol interference in random channels are studied. The first one is observed to be useful when the channel is slowly varying as compared with the signal transmission rate. The second procedure is shown to have an advantage over the slowly-varying method in that the selectivity of the medium can be easily incorporated. For the slowly-varying channel, a unified analysis of the effects of fading and intersymbol interference due to filtering is presented for both the Rayleigh and the Rician fading channel. The matched filter operation is replaced by a Butterworth filter at the front end of the receiver. It is observed that when no diversity is used (L=1), the main degradation of the performance curves is due to fading, but when this degradation is totally or partially eliminated (perhaps using diversity) the effects of bandlimiting become an important factor for the design. Dissert. Abstr.

N73-32050 Johns Hopkins Univ., Baltimore, Md.
A STUDY OF RADIO FREQUENCY INDUCED SIDEBANDS ON RECOILLESS RAYLEIGH AND MOESSBAUER GAMMA RADIATION Ph.D. Thesis
Robert F. Heile 1973 136 p
Avail: Univ. Microfilms Order No. 73-16645

The phenomenon of radio frequency induced sidebands in ferromagnetically ordered foils is studied. The appearance of sidebands in the Mossbauer spectra of ferromagnetic compounds and in the recoilless Rayleigh scattering of 14.4 keV gamma rays from nickel foils subjected to a RF magnetic field is reported. The result makes more conclusive the suggestion that the sidebands arise from bulk magnetostriction of ferromagnetic materials. The magnetostrictive model is given a firmer foundation

by experimentally establishing the dependence of the sideband intensities on the magnetostriction constant for iron-nickel alloys. Dissert. Absr.

N73-32051 Clarkson Coll. of Technology, Potsdam, N.Y.
ROBUST DETECTION OF TIME VARYING SIGNALS Ph.D. Thesis
Jonnalagadda Krishnamurthy 1973 219 p
Avail: Univ. Microfilms Order No. 73-14851

A class of robust detection schemes for the detection of a class of time varying signals in additive disturbance are proposed and analyzed and their performance is evaluated. The proposed detection schemes are applicable for the detection of both binary and M-ary, amplitude shift keyed, frequency shift keyed signals and phase shift keyed signals. Three detection schemes are proposed for solving the detection problem when the samples of the received signal contain pure signal components that are all unequal. These detection schemes are designated as Nonparametric Detection Scheme (NDS), Detection Scheme with Fixed Thresholds (DSFT) and Detection Scheme with Learning of Thresholds (DSLT). The performance of these detectors is compared with that of the least squares detector. It is observed that the proposed detection schemes are robust and generally lead to lower probability of error. Dissert. Abstr.

N73-32052 Missouri Univ., Rolla.
A LEARNING RECEIVER FOR COMMUNICATION IN THREE-COMPONENT MULTIPATH CHANNELS Ph.D. Thesis
Richard Paul Brueggemann 1972 81 p
Avail: Univ. Microfilms Order No. 73-17090

An adaptive receiver is designed for transmissions through a time-varying multipath channel which may include both specular and diffuse components. The design is based on the theory of unsupervised learning machines and the receiver is a recursive structure which does not grow in complexity with each new observation, but is Bayes' optimal at each instant of time. The multipath medium is modelled as an aggregate of L conditionally independent transmission paths, each consisting of random and/or fixed reflections. The channel parameters are time-varying and either independent from one signaling interval to the next or at most M-th order Markov dependent. A review of machines that learn without a teacher is presented and the learning receiver for three-component multipath is designed and modelled on the digital computer. Dissert. Abstr.

N73-32053# Advisory Group for Aerospace Research and Development, Paris (France).
SPREAD SPECTRUM COMMUNICATIONS
Jul. 1973 196 p refs
(AGARD-LS-58) Avail: NTIS HC $12.00

The theory, implementation, and application of state-of-the-art spread spectrum techniques to advanced communication systems are discussed. The fundamental and theoretical aspects of communication theory, digital communications theory, and spread spectrum communications are reported. The practical aspects of spread spectrum techniques, particularly the performance and synchronization considerations, and several state-of-the-art applications are described. Predictions of future communication systems with spread spectrum methodology are included. For individual titles, see N73-32054 through N73-32058.

N73-32054 Rensselaer Polytechnic Inst., Troy, N.Y. Systems Engineering Div.
SOME FUNDAMENTAL NOTIONS OF COMMUNICATION THEORY
Lester A. Gerhardt *In* AGARD Spread Spectrum Commun. Jul. 1973 24 p refs (For availability see N73-32053 23-07)

The basic concepts of communications theory to include the transmission of continuous signals and the use of discrete time signals are presented. A numerical analysis of communication signals, the spectral characteristics of the signals, and a probabilistic description of the signals are developed. The basic types of modulation, to include amplitude, pulse, and angle modulation and related forms are examined. The characteristics of the signal receiver with emphasis on signal detection and filtering are described. The effect of the sampling theorem on the spectral characteristics of signals is analyzed. The problems of quantization are outlined for discrete time and discrete amplitude signals. Author

N73-32055 Manchester Univ. (England). Dept. of Electrical Engineering and Electronics.
DIGITAL COMMUNICATIONS THEORY
Geoffrey F. Gott *In* AGARD Spread Spectrum Commun. Jul. 1973 16 p refs (For availability see N73-32053 23-07)

The characteristics of digital communication systems and the processing of bandpass digital signals are discussed. The modulation and detection of frequency shift keyed and phase shift keyed signals are considered in binary and multilevel form. Emphasis is placed on radio frequency data transmission where spread spectrum techniques have application. Methods of providing protection against the effects of signal fading due to multipath propagation are analyzed. Elementary forward error correcting codes of the type used in radio frequency channels are examined. Author

N73-32056 Signals Research and Development Establishment, Christchurch (England).
INTRODUCTION TO SPREAD SPECTRUM TECHNIQUES
R. L. Harris *In* AGARD Spread Spectrum Commun. Jul. 1973 21 p (For availability see N73-32053 23-07)

The basic principles and operation of a spread spectrum communication system are discussed. Spectrum spreading by means of direct modulation is considered in detail and compared with an alternative method using frequency hopping. A key feature of any spread spectrum system is the pseudo random sequence and the basic properties and generation of such sequences are discussed. Finally the performance of a typical satellite communication system using spread spectrum as a multiple access method is calculated. Author

N73-32057 Communications Research Centre, Ottawa (Ontario).
PERFORMANCE AND SYNCHRONIZATION CONSIDERATIONS
N. G. Davies *In* AGARD Spread Spectrum Commun. Jul. 1973 24 p refs (For availability see N73-32053 23-07)

The performance of spread spectrum systems in the presence of various forms of channel noise is analyzed. The synchronization aspects of spread spectrum systems are examined. The subjects discussed are: (1) acquisition by search in the time and frequency domains, (2) the use of preambles and special sequences for synchronization, and (3) the establishment of synchronization detection and tracking criteria. Author

N73-32058 Magnavox Research Labs., Torrance, Calif.
SPREAD SPECTRUM APPLICATIONS AND STATE OF THE ART EQUIPMENTS
Charles R. Cahn *In* AGARD Spread Spectrum Commun. Jul. 1973 111 p refs (For availability see N73-32053 23-07)

The applications of spread spectrum communications to avionics systems are described. The following topics are discussed: (1) multiple access capabilities, (2) interference rejection, (3) identification characteristics, and (4) distance measuring and position location capabilities. The characteristics and uses of current spread spectrum equipment are reported. Recent technology discoveries, such as acoustic surface wave and charge coupled devices are explained. Author

N73-32059*# Ohio State Univ., Columbus.
A PARAMETRIC STUDY OF CUT-OFF CORRUGATED SURFACE PROPERTIES
C. A. Mentzer and L. Peters, Jr. Washington NASA Oct. 1973 59 p refs
(Contract NAS1-10040)
(NASA-CR-2317) Avail: NTIS HC $3.50 CSCL 17B

Corrugated horns involve a junction between the corrugated surface and a conducting groundplane. Proper horn design requires an understanding of the electromagnetic properties of the corrugated surface and this junction. Therefore, an integral equation solution has been used to study the influence of corrugation density and shape on the power loss. Surface current, and the scattering from a groundplane-corrugated surface junction. Both square and vee shape corrugations have been considered

over the range of corrugation depths where the surface acts as a cut-off corrugated surface. Author

N73-32060*# Michigan Univ., Ann Arbor. Radiation Lab.
ANTENNA ARRAY RESEARCH Final Technical Report, 1 Jul. 1972 - 30 Jun. 1973
Chen-To Tai Jul. 1973 19 p refs
(Grant NGR-23-005-477)
(NASA-CR-132336; Rept-010106-1-F) Avail: NTIS HC $3.00 CSCL 17B

Antenna array research on electromagnetic field problems in inhomogeneous media is presented along with characteristics of the Eaton lens. Comparisons are given of the radiation pattern and directivity of small Luneburg lens with a homogeneous lens. References and figure captions on radiation patterns are included. T.M.R.

N73-32061# National Aviation Facilities Experimental Center, Atlantic City, N.J.
COMMON DIGITIZER (FYQ-47) RADIO FREQUENCY INTERFERENCE MEASUREMENTS AT THE ELWOOD, NEW JERSEY, LONG RANGE RADAR SITE Interim Report, Feb. - Mar. 1973
George C. Apostolakis and John J. Fisher, Jr. Oct. 1973 56 p
(FAA-NA-73-41; FAA-RD-73-123) Avail: NTIS HC $5.00

Operating long range radar sites (LRRS) have reported that the common digitizer (CD) interferes with the back up emergency communications (BUEC) equipments when the CD doors are opened for maintenance purposes. An investigation was made of the problem considering radio frequency interference (RFI) field strength measurements at various locations, both inside and outside the LRRS building as well as on the roof and radome catwalk. The measurements were made for various combinations of equipments being on with the CD doors both opened and closed. It was determined that the CD with doors open is the major source of RFI. The radiating source within the CD was traced to its core memory. With the CD doors closed, RFI is reduced to negligible levels; furthermore, the roof of the building reduces the CD RFI to negligible proportions. Author

N73-32062*# Analytical Systems Corp., Burlington, Mass.
THUNDERSTORMS AND GROUND-BASED RADIO NOISE AS OBSERVED BY RADIO ASTRONOMY EXPLORER 1 Final Report, 18 May - 17 Nov. 1972
Joseph A. Caruso and John R. Herman 5 Apr. 1973 63 p refs
(Contract NAS5-23121)
(NASA-CR-132810) Avail: NTIS HC $5.25 CSCL 17B

Radio Astronomy Explorer (RAE) data were analyzed to determine the frequency dependence of HF terrestrial radio noise power. RAE observations of individual thunderstorms, mid-ocean areas, and specific geographic regions for which concommitant ground based measurements are available indicate that noise power is a monotonically decreasing function of frequency which conforms to expectations over the geographic locations and time periods investigated. In all cases investigated, active thunderstorm regions emit slightly higher power as contrasted to RAE observations of the region during meteorologically quiet periods. Noise levels are some 15 db higher than predicted values over mid-ocean, while in locations where ground based measurements are available a maximum deviation of 5 db occurs. Worldwide contour mapping of the noise power at 6000 km for five individual months and four observing frequencies, examples of which are given, indicate high noise levels over continental land masses with corresponding lower levels over ocean regions. Author

N73-32063*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DUAL DIGITAL VIDEO SWITCHER Patent Application
Ian A. Richter, inventor (to NASA) Filed 25 Sep. 1973 33 p
(NASA-Case-KSC-10782-1; US-Patent-Appl-SN-400467) Avail: NTIS HC $3.75 CSCL 09F

A system for manually and automatically coupling video signals from cameras to a monitoring apparatus is reported. The system has a manual mode of operation, a continuous scan mode, a single scan mode and a hold condition. The scanning mode is controlled by a shift register which can be activated at various rates so as to vary the duration that a particular video signal is coupled to the monitoring apparatus. If the system is in the scan mode a push button can be depressed to hold the video signal coupled to the monitoring system until the operator desires to return to the scan cycle. Various logic circuits are utilized in the system for selecting a predetermined scanning sequence, as well as to permit the circuit to be manually operable under control of an operator. NASA

N73-32064*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 17 Progress Report, Jul. - Aug. 1973
15 Oct. 1973 158 p refs
(Contract NAS7-100)
(NASA-CR-135708; JPL-TR-32-1526-Vol-17) Avail: NTIS HC $10.00 CSCL 17B

The objectives, functions, and organization of the Deep Space Network are summarized. The Deep Space Instrumentation Facility, the Ground Communications Facility, and the Network Control System are described. Author

N73-32065*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE THEORY, DESIGN, AND OPERATION OF THE SUPPRESSED CARRIER DATA-AIDED TRACKING RECEIVER
M. K. Simon and J. C. Springett 15 Jun. 1973 76 p refs
(Contract NAS7-100)
(NASA-CR-135714; JPL-TR-32-1583) Avail: NTIS HC $6.00 CSCL 17B

A viable, efficient, and easily mechanized carrier regenerating receiver for use in suppressed carrier-tracking system is described. The receiver referred to as a data-aided receiver (DAR) incorporates a data-aided loop (DAL) which provides the required carrier reference signal. The DAL employs the principle of decision feedback and as such is more efficient than other forms of suppressed carrier-tracking loops. The analysis, design, and implementation of the DAR are covered in detail. Performance comparisons and mechanization tradeoffs are made, wherever possible, with discrete carrier systems and other suppressed carrier systems presently in use. Experimental performance verification is given throughout in support of the theory presented. Author

N73-32066# Office Radiodiffusion et Television Francaise, Paris. Service de la Recherche.
NEW MEANS OF AUDIOVISUAL MESSAGE TRANSMISSION: VOLUME C: VIDEO CASSETTES [NOUVEAUX MOYENS DE DIFFUSION DE MESSAGES AUDIO-VISUELS VOLUME C VIDEO-CASSETTES]
Henri False and Serge Gregory-Brive Apr. 1972 167 p In FRENCH 3 Vol.
Avail: NTIS HC $10.50

A review of existing systems and future technical developments for video-cassette recording devices is presented. Read only systems, such as helicoidal magnetoscopes and super 8 telecinemas, are described and compared. The market situation and property rights problems are analyzed. The activities of various commercial organizations in a number of nations are reviewed. ESRO

N73-32067# Office Radiodiffusion et Television Francaise, Paris. Service de la Recherche.
NEW MEANS OF AUDIOVISUAL MESSAGE TRANSMISSION: VOLUME B: CABLE TELEVISION [NOUVEAUX MOYENS DE DIFUSION DE MESSAGES AUDIO-VISUELS VOLUME B TELEVISION PAR CABLES]
Henri False and Serge Gregory-Brive Dec. 1972 96 p In FRENCH 3 Vol.
Avail: NTIS HC $7.00

A review of existing systems and future technical developments for video broadcasting by means of cables is presented. Systems of the CATV type, HF type, and dial-a-program type are described and compared. Future technical developments such as channel number extension and return lines, together with the problems of multiple networks vs integrated networks, are discussed. Juridical and economical aspects in the U.S. and various European nations are analyzed. ESRO

N73-32068# Office Radiodiffusion et Television Francaise, Paris. Service de la Recherche.
NEW MEANS OF AUDIOVISUAL MESSAGE TRANSMISSION: VOLUME A: SPACE COMMUNICATIONS [NOUVEAUX MOYENS DE DIFFUSION DE MESSAGES AUDIOVISUELS VOLUME A LES TELECOMMUNICATIONS SPATIALES]
Suzanne Carette, Henri False, and Serge Gregory-Brive Dec. 1971 101 p In FRENCH 3 Vol.
Avail: NTIS HC $7.25

A review of present and future communication satellite systems for broadcasting and video communications is presented. Various types of satellite configurations, transmission techniques, and applications are described. Emphasis is on domestic, regional, international systems and projects noting educational aspects. ESRO

N73-32069# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
NONCONVENTIONAL ASPECTS OF RADAR TARGET CLASSIFICATION BY POLARIZATION PROPERTIES Ph.D. Thesis. Final Report
Karl H. Steinbach Jun. 1973 183 p refs Transl. into ENGLISH of Ph.D. Thesis, Technische Hochschule, Hanover
(DA Proj. 1J6-62712-AJ-22)
(AD-763155; USAMERDC-2065) Avail: NTIS CSCL 17/9

Manmade objects embedded in inhomogeneous media such as soils, building materials, and atmospheric layers may be detected by radar-like systems. The report reviews the system requirements and examines the role polarization phenomena can play in meeting these requirements. The scattering properties of potential targets and other disturbances in the medium as well as surface reflections and attenuation effects are taken into consideration. Rigorous equations describing the depolarized echo of radar reflectors as a function of their physical shape and the polarizational state of the incident wave are derived. The scattering theory of G. MIE is extended to include dissipative media and to permit the computation of the radar cross section of spheres for any combination of complex material constants. (Modified author abstract) GRA

N73-32070# Army Missile Command, Redstone Arsenal, Ala.
THE ANGLE TRACKING COMPUTER (ATRAC) FOR THE EXPERIMENTAL ARRAY RADAR SYSTEM
W. Allen Cochrane and Stanley E. Prevost 25 Jun. 1973 126 p refs
(DA Proj. 1M2-62303-A-214)
(AD-764224; RE-73-21) Avail: NTIS CSCL 17/9

One of the earliest problems encountered and solved by investigators in the field of radar was that of measuring and presenting the error between the antenna axis and the target. Errors in pointing direction are determined by sensing the angle of arrival of the echo wavefront and correcting the antenna position to keep the target centered in the beam. The principal applications of tracking radars are weapon control and missile range instrumentation. Several techniques have been used to implement angle tracking in radar systems. For example the conical-scan, sequential-lobing, and monopulse (both phase comparison and amplitude comparison) are well known techniques described in the literature. Since the US Army Missile Command's Experimental Array Radar (EAR) System is a phase-monopulse radar, this technique is described in detail in the text of this report. (Modified author abstract) GRA

N73-32071# Texas Univ., Austin. Applied Research Labs.
ELECTROACOUSTIC PROJECTOR DESIGN GUIDELINES FOR HIGH SOURCE LEVEL, LONG DUTY CYCLE APPLICATIONS Final Report, 1 Apr. 1972 - 31 Mar. 1973
Louis H. Fowler 14 Jun. 1973 36 p refs
(Contract N00014-70-A-0166-0011; NR Proj. 240-014)
(AD-764572; ARL-TR-73-24) Avail: NTIS CSCL 17/1

In an effort toward the development of guidelines for consideration of thermal properties of ceramic in the design of electroacoustic projectors, a mathematical model for predicting changes in ceramic temperature of projectors operating at the high power levels was developed and tested. The change in ceramic temperature as a function of heat dissipated in the ceramic was measured for two projectors under various operating conditions at ARL's Lake Travis Test Station. A determination of the unknown constant of proportionality gamma was made on the basis of the data obtained. The average value gamma should be useful in estimating temperature rise in a sonar array similarly constructed, using Channelite 5400 ceramic elements. The extent this value of gamma can be extrapolated is unknown at present. Author (GRA)

N73-32072# California Univ., Los Angeles. Dept. of System Sciences.
MAXIMUM LIKELIHOOD RECEIVER FOR BINARY SIGNALS WITH INTERSYMBOL INTERFERENCE IN GAUSSIAN NOISE
K. Yao and L. B. Milstein (Hughes Aircraft Co., El Segundo, Calif.) 1973 8 p refs Presented at the IEEE 1973 Intern. Conf. on Commun., Seattle, 11-12 Jun. 1973
(Contract N00014-69-A-0200-4043; NR Proj. 042-285)
(AD-764641) Avail: NTIS CSCL 09/4

Three equivalent forms of the optimum (maximum-likelihood) bit-by-bit nonlinear detector structure for binary signals with intersymbol interference in the presence of additive stationary Gaussian noise are given. Basic properties of this detector as functions of the complexity of the detector structure and of the observation time are studied. An analytically tractable tight approximation as well as specific numerical results (for a two-pole Butterworth filter transfer function) on probability of error are presented. For various observation durations the authors show explicitly the advantage of using the nonlinear receiver over either a conventional matched filter receiver or the optimum linear transversal filter receiver. Author (GRA)

N73-32073# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TRANSIENT SIGNAL PROPAGATION IN LOSSY PLASMAS Physical Sciences Research Papers
Ronald L. Fante and Richard L. Taylor 25 Apr. 1973 40 p refs
(AF Proj. 5635)
(AD-764721; AFCRL-TR-73-0277; AFCRL-PSRP-546) Avail: NTIS CSCL 20/9

Using contour integration techniques, the authors have calculated the transient response of a lossy homogeneous isotropic plasma to a unit step and a step-carrier sine wave. It was found that in the presence of losses the temporal step function response within the plasma does not approach zero for large time as for the collisionless case, but rather approaches unity. The rate at which the transient approaches the asymptotic value of unity is strongly dependent on the losses, being quite rapid for large losses and exceedingly slow for very small losses. This result has an important impact on the propagation of EMP through the plasma sheath around a reentry vehicle, and through the ionized region near a low altitude nuclear fireball. Author (GRA)

N73-32074# Army Electronics Command, Fort Monmouth, N.J.
ANALYSIS AND DESIGN OF STACKED-CRYSTAL FILTERS FOR FREQUENCY CONTROL AND SIGNAL PROCESSING Research and Development Technical Report
Arthur D. Ballato, Henry L. Bertoni, and Theodor Tamir May 1973 32 p refs
(DA Proj. 1S6-62705-A-058)
(AD-765416; ECOM-4119) Avail: NTIS CSCL 09/5

A class of novel frequency-selective devices, called stacked-crystal filters, is discussed in terms of a microwave network approach that leads to a systematic procedure for their analysis and design. These devices consist of two or more crystal plates that are stacked together, with thin electrodes being provided between some or all of the adjacent interfaces for the purpose of translating mechanical properties into electrical signals via piezoelectric coupling. In such a configuration, the electromechanical coupling that occurs at the plate surfaces produces selective interactions between the elastic modes in each crystal plate, as well as between these modes and all of the modes in the other plates included in a stack. A judicious combination of materials and dimensions can therefore provide a very wide range of desired filtering characteristics. (Modified author abstract) GRA

N73-32075# Naval Ordnance Lab., White Oak, Md.
ELECTROMAGNETIC SCATTERING BY APERTURES. 7: THE ANNULARLY SLOTTED SPHERE THEORY
Joseph P. Heckl, Louis F. Libelo, and John N. Bombardt Jul. 1973 41 p refs
(ZR0110101; HDL Proj. E052)
(AD-764880; NOLTR-73-84) Avail: NTIS CSCL 20/14

The authors present the formal derivation of two sets of pairs of coupled integral equations. These arise in the scattering of an incident plane wave by a perfectly conducting sphere with an annular slot defined by means of two angles. The incident radiation is assumed for simplicity to be along the symmetry axis of the slotted sphere. Simple but quite remarkable relations between the sets of coupled equations are indicated. The formal solution for the complementary geometry, namely, the perfectly conducting spherical ribbon is also presented. Author (GRA)

N73-32076# Army Foreign Science and Technology Center, Charlottesville, Va.
PRINCIPALS OF RADAR AND METEOROLOGICAL RADAR DEVICES
Oleg G. Korol and Rim D. Chernyak 19 Jun. 1973 138 p refs Transl. into ENGLISH from an unidentified Russian monograph
(AD-765363; FSTC-HT-23-149-73) Avail: NTIS CSCL 17/9

Three meteorological radar units are described: the Malachite radiotheodolite with rangefinder attachment, the Meteorite radar station, and the MRL radar station. The principles of operation of these systems are given along with circuit descriptions and explanations of the operation of the individual units within each system. (Modified author abstract) GRA

N73-32077# Owens-Illinois, Inc., Pittsburgh, Pa. Fecker Systems Div.
OPTICAL RADAR ANGLE TRACKING MOUNT Interim Report, Apr. 1972 - May 1973
George J. Thompson and Spiro Pappas Jul. 1973 90 p
(Contract F30602-72-C-0192; ARPA Order 1279)
(AD-765213; F(4)-864-047-022-2251; RADC-TR-73-205) Avail: NTIS CSCL 17/8

The report consists of an environmental analysis in two parts: random solar heat pointing error; and the hydrostatic bearings design in three parts: azimuth axis thrust bearing, azimuth axis radial bearing, and evaluation axis radial bearing. These subjects are critical design criteria for the optical radar angle tracking mount. Author (GRA)

N73-32078# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TECHNIQUES OF TIME TRANSFER VIA SATELLITES Physical Sciences Research Papers
John C. Herring 16 Feb. 1973 23 p refs Presented at 12th Pan Am. Consultation on Cartography, Panama, 1973
(AF Proj. 7600)
(AD-764716; AFCRL-TR-73-0226; AFCRL-PSRP-540) Avail: NTIS CSCL 17/2

The distribution of precision-time and time interval (PTTI) information has been accomplished in the past by various methods. The most accurate method has been the transportation of a cesium frequency standard to the required location and return. In many instances transporting a cesium standard is too expensive for the accuracy of the transfer of PTTI required. Transfer of time via satellite transponders is not new. What is new is the method of computing delay corrections. The technique of a passive one-way timing technique with field correction for atmospheric delay is discussed. Author (GRA)

N73-32079# IIT Research Inst., Annapolis, Md.
COMMUNICATION/ELECTRONIC RECEIVER PERFORMANCE DEGRADATION HANDBOOK
Frank Kravitz Electromagnetic Compatibility Analysis Center Jul. 1973 169 p refs Sponsored in part by Dept. of Commerce
(Contract F19628-73-C-0031; AF Proj. 649E)
(AD-764710; ESD-TR-73-014) Avail: NTIS CSCL 17/2

The Receiver Performance Degradation Handbook provides reference curves for determining receiver performance as a function of input signal-to-interference ratio. The performance degradation curves were obtained using both simulation models and measured data. The desired signal modulation types considered are A2, A3, A3J, A9B, F1, F3 and P9. The interference modulation types are A1, A3, A3J, A9B, F1, F3, F9, PO and noise. Author (GRA)

N73-32080# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
IDENTIFICATION OF RADAR TARGETS BY PATTERN RECOGNITION Ph.D. Thesis
William B. Goggins, Jr. 26 Feb. 1973 133 p refs
(AF Proj. 5635)
(AD-764713; DS/EE/73-1; AFCRL-TR-73-0126; SR-159) Avail: NTIS CSCL 19/9

The problem of identifying radar targets without predetermined knowledge or measurements of their aspect angle is examined. The proposed solution is to use radar magnitude and phase versus frequency data in the resonance region as input data for pattern recognition techniques. Practical methods are developed for measuring radar phase and dealing with polarization effects. Pattern recognition algorithms that optimize separation between pairs of input data are developed. These algorithms are based on digital spatial frequency filtering of curves of the radar return versus the radar frequency. The technique is simulated on a digital computer for three objects - a cylinder, a cone, and a step cylinder - all of about the same size. Results show that at most aspect angles, satisfactory recognition is attained at moderate signal-to-noise ratios. Author (GRA)

N73-32674 Joint Publications Research Service, Arlington, Va.
OPTICAL MODELING OF THE RADIATION PATTERN OF A VARIABLE PROFILE ANTENNA OPERATING IN THE HARTMAN DIAPHRAGM MODE
A. N. Korzhavin and V. M. Spitkovskiy *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 14-18 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 661-664 (For availability see N73-32671 23-30)

N73-32677 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF THE POLARIZATION CHARACTERISTICS OF THE LARGE PULKOVO RADIOTELESCOPE
N. A. Yesenkina, N. S. Bakhvalov, L. G. Vasilyeva, N. A. Soboleva, and A. V. Temirova *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 30-38 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 669-675 (For availability see N73-32671 23-30)

N73-32718* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VERIFICATION OF PERFORMANCE OF THE MARINER 9 TELEVISION CAMERAS
T. E. Thorpe *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 499-510 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 09F

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-32081* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DIGITAL TO ANALOG CONVERSION APPARATUS Patent
William P. Dotson, Jr., inventor (to NASA) Issued 21 Aug. 1973 10 p Filed 13 Oct. 1971 Supersedes N72-11209 (10 - 02, p 0176)
(NASA-Case-MSC-12458-1; US-Patent-3,754,236; US-Patent-Appl-SN-188927; US-Patent-Class-340-347DA; US-Patent-Class-235-152IE) Avail: US Patent Office CSCL 09B

A digital to analog converter which improves the accuracy of reconstruction of a sampled analog signal without requiring that the sampling rate of the original signal be increased to obtain such accuracy. Official Gazette of the U.S. Patent Office

N73-32082# Weapons Research Establishment, Adelaide (Australia).
THIN FILM FILTERS DESIGNED BY THE METHOD OF EQUIVALENT LAYERS
M. S. Brown Mar. 1973 29 p refs
(WRE-TN-903(AP)) Avail: NTIS HC $3.50

A computer program is described which calculates and plots the equivalent refractive index and optical thickness of symmetrical multilayer thin film constructions. The plotted values of index and thickness for several different material combinations are used to design high and low pass edge filters and a bandpass filter. Author

N73-32083# Defence Research Board, Ottawa (Ontario).
A HYBRID INTERACTIVE SEARCH SYSTEM
John D. Currie Aug. 1973 9 p refs Presented at 1st Open Conf. on Inform. Sci. in Canada, Montebello, Quebec, 1973
(DSIS-TN-13) Avail: NTIS HC $3.00

A flexible hybrid system is reported in which bulk storage is in microform, while dictionaries used in searching are stored in a computerized data bank. The economics, response time and search methods of the Defence Scientific Information Service (DSIS) retrospective search system are examined. Author

N73-32084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SMALL INTERACTIVE IMAGE PROCESSING SYSTEM (SMIPS) USERS MANUAL
Johannes G. Moik Sep. 1973 67 p refs
(NASA-TM-X-70472; X-650-73-283) Avail: NTIS HC $5.50 CSCL 09B

The Small Interactive Image Processing System (SMIP) is designed to facilitate the acquisition, digital processing and recording of image data as well as pattern recognition in an interactive mode. Objectives of the system are ease of communication with the computer by personnel who are not expert programmers, fast response to requests for information on pictures, complete error recovery as well as simplification of future programming efforts for extension of the system. The SMIP system is intended for operation under OS/MVT on an IBM 360/75 or 91 computer equipped with the IBM-2250 Model 1 display unit. This terminal is used as an interface between user and main computer. It has an alphanumeric keyboard, a programmed function keyboard and a light pen which are used for specification of input to the systdm. Output from the system is displayed on the screen as messages and pictures. Author

N73-32085*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SMALL INTERACTIVE IMAGE PROCESSING SYSTEM (SMIPS) SYSTEM DESCRIPTION
Johannes G. Moik Sep. 1973 48 p refs
(NASA-TM-X-70473; X-650-73-286) Avail: NTIS HC $4.50 CSCL 09B

The Small Interactive Image Processing System (SMIPS) operates under control of the IBM-OS/MVT operating system and uses an IBM-2250 model 1 display unit as interactive graphic device. The input language in the form of character strings or attentions from keys and light pen is interpreted and causes processing of built-in image processing functions as well as execution of a variable number of application programs kept on a private disk file. A description of design considerations is given and characteristics, structure and logic flow of SMIPS are summarized. Data management and graphic programming techniques used for the interactive manipulation and display of digital pictures are also discussed. Author

N73-32086*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTIMIZATION TECHNIQUES FOR FORTRAN 4 (G AND H) PROGRAMS WRITTEN FOR THE IBM 360 UNDER OS
John L. Dean Mar. 1971 45 p Prepared by Boole and Babbage, Inc., Cupertino, Calif.
(Contract NAS5-11799)
(NASA-TM-X-70477; X-543-71-99) Avail: NTIS HC $4.25 CSCL 09B

A fairly complete list is reported of programming techniques which are available to the programmer for optimizing the execution time of production programs written in FORTRAN IV (G and H) for the IBM 360 under OS. After the program has been complied under FORTRAN H, OPT = 2, then the process of actually changing code begins. The bulk of execution time of FORTRAN programs can almost always be attributed to a few loops, and primary consideration is given to these. Author

N73-32087*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
DEVELOPMENT OF AIFTDS-4000, A FLIGHT-QUALIFIED, FLEXIBLE, HIGH-SPEED DATA ACQUISITION SYSTEM
Robert W. Borek 1973 13 p ref
(NASA-TM-X-56018) Avail: NTIS HC $3.00

The NASA flight research center has developed a prototype data acquisition system which integrates an airborne computer with a high-speed pulse code modulation system. The design of the airborne integrated flight test data system (AIFTDS) is the result of experience with airborne pulse code modulation data systems. The AIFTDS-4000 has proved the premise on which it was designed: that the needs and requirements of data acquisition system users can be integrated to produce a highly flexible system that will be more useful than existing systems. Author

N73-32088*# TRW Systems Group, Redondo Beach, Calif. Power Systems Dept.
PROGRAMMER'S GUIDE FOR THE GNAT COMPUTER PROGRAM (NUMERICAL ANALYSIS OF STRATIFICATION IN SUPERCRITICAL OXYGEN)
J. P. Heinmiller Feb. 1971 142 p refs
(Contract NAS9-8166)
(NASA-CR-134054; TRW-17618-H106-R0-00) Avail: NTIS HC $9.25 CSCL 09B

This document is the programmer's guide for the GNAT computer program developed under MSC/TRW Task 705-2. Apollo cryogenic storage system analysis, subtask 2, is reported. Detailed logic flow charts and compiled program listings are provided for all program elements. Author

N73-32089*# National Aeronautics and Space Administration, Washington, D.C.
COMPUTER PROGRAMS: OPERATIONAL AND MATHEMATICAL, A COMPILATION
[1973] 13 p
(NASA-SP-5962(01)) Avail: NTIS HC $1.00 CSCL 09B

Several computer programs which are available through the NASA Technology Utilization Program are outlined. Presented are: (1) Computer operational programs which can be applied to resolve procedural problems swiftly and accurately. (2) Mathematical applications for the resolution of problems encountered in numerous industires. Although the functions which these programs perform are not new and similar programs are available in many large computer center libraries, this collection may be of use to centers with limited systems libraries and for instructional purposes for new computer operators. Author

N73-32090*# Aerophysics Research Corp., Hampton, Va.
DIALOG: AN EXECUTIVE COMPUTER PROGRAM FOR LINKING INDEPENDENT PROGRAMS Final Report, Mar. 1971 - Jun. 1972
C. R. Glatt, D. S. Hague, and D. A. Watson Washington NASA Sep. 1973 141 p refs
(Contract NAS1-10692)
(NASA-CR-2296) Avail: NTIS HC $4.50 CSCL 09B

A very large scale computer programming procedure called the DIALOG executive system was developed for the CDC 6000 series computers. The executive computer program, DIALOG, controls the sequence of execution and data management function for a library of independent computer programs. Communication of common information is accomplished by DIALOG through a dynamically constructed and maintained data base of common information. Each computer program maintains its individual identity and is unaware of its contribution to the large scale program. This feature makes any computer program a candidate for use with the DIALOG executive system. The installation and uses of the DIALOG executive system are described. Author

N73-32091# Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).

AUTOMATIC LOCALIZATION OF OBJECTS BY MEANS OF SCENE ANALYSIS [AUTOMATISCHE LOKALISIERUNG VON OBJEKTEN MITTELS SZENENANALYSE]
M. Sties Bonn Bundeswehramt Feb. 1973 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. Fuer Verteidigung
(BMVg-FBWT-73-14) Avail: NTIS HC $4.75; Bundeswehramt 25 DM

The basic principles of a method for the analysis of scenes are recalled and newly developed algorithms are presented. An automatic method for the description of models and a general procedure for localization of objects via comparison of both model and scene descriptions, are described. Examples of scenes are given and results discussed. ESRO

N73-32092# Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).
GENERATION OF LINE-CONTAINING PICTURE SAMPLES FROM GRAY LEVEL PICTURES USING CONTRAST GRADIENTS [ERZEUGUNG LINIENHAFTER BILDMUSTER AUS GRAUTONBILDERN MIT HILFE DER KONTRAST-GRADIENTEN]
R. Schaerf Bonn Bundeswehramt 1973 107 p refs In GERMAN; ENGLISH summary
(BMVg-FBWT-73-10) Avail: NTIS HC $7.50; Bundeswehramt 25 DM

A simulation method analyzing the amplitude and phase relationship of the scanned signals of a picture to localize edges in gray level pictures is described. The preprocessor coupled with the flying spot scanner is also presented. In a second step, the results obtained serve as input data to produce the desired edge information. Two heuristic tracing algorithms are described which are work line or object oriented. ESRO

N73-32093# National Physical Lab., Teddington (England). Div. of Computer Science.
PL-516 IN PL-516, THE TEXT, SYNTAX AND INFORMAL DESCRIPTION OF A HIGH-LEVEL ASSEMBLER
Donald A. Bell Jan. 1973 83 p refs
(NPL-COM-SCI-65) Avail: NTIS HC $6.25

The complete text of the compiler for the high level assembly language PL-516, used on the Honeywell DDP-516 computer, is given. The syntax of the language is reproduced in a modified Backus-Naur notation. Each of the syntatic units corresponds to a routine or part of a routine in the compiler. These are described in sufficient detail for the text to become intelligible, and to show the inter-relationship of the various routines, markers, counters and arrays. The basic utility routines are described first, followed by those which compile declarations, expressions, conditions and statements. A complete program of about 300 machine code instructions is used to illustrate how the compiler deals with most of the constructions of the design philosophy of the whole PL-516 project. Author (ESRO)

N73-32094# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d' Automatique et d'Analyse des Systemes.
RESEARCH AND DEVELOPMENT OF A MULTIPLICATION-DIVISION OPERATOR FOR THE ASMODEE MINI-PROCESSOR [CONCEPTION ET REALISATION D'UN OPERATEUR MULTIPLICATION-DIVISION POUR LE MINIPROCESSEUR A.S.M.O.D.E.E.]
M. Souny and J. C. Laprie Jan. 1973 82 p refs In FRENCH
(LAAS-TNPE-73-I-07) Avail: NTIS HC $6.25

A hybrid computer multiplication-division modular unit for the ASMODEE miniprocessor is presented. Three state integrated circuit gates are used for multiplexing purposes. Algorithms for combinational multiplication and division are discussed. Floating point arithmetic is used throughout. Accuracy, right and left shift registers, and the application of microprogrammed sequential generators are discussed. A complete unit is described, load instructions, testing, memory programming, and program simulation are detailed, and schematic diagrams are given. An instruction manual is included. ESRO

N73-32095# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
INTRODUCTION TO THE USE OF FORTRAN-WATFIV COMPILER [INTRODUCTION A L'UTILISATION DU COMPILATEUR FORTRAN-WATFIV]
G. Bouyssou Jan. 1973 21 p In FRENCH
(LAAS-NT-SIS-73-T-04) Avail: NTIS HC $3.25

The FORTRAN-WATFIV is described as a code and go compiler using 95 K bytes of central core memory. A list of incompatibilities with FORTRAN G and H extended are given with regard to nested DO loop extended range, COMMON, DEBUG, DUMP, PDUMP statements. The compiler is faster by a factor 2 to 5 with respect to FORTRAN G. WATFIV specific language extensions are detailed and examples given. Two levels of control cards are required and their content detailed: program load cards and compiler related cards. The latter are needed in view of the one-step operation of WATFIV. Indications are given for the evaluation of core memory available for program execution. ESRO

N73-32096# Rome Air Development Center, Griffiss AFB, N.Y.
DIA GRAPHICS TESTBED SYSTEM Technical Report, Aug. 1971 - Dec. 1972
Jackson T. Cole, Thomas J. Anderson, and Richard A. Metzger May 1973 156 p
(AF Proj. 5597)
(AD-764353; RADC-TR-73-50) Avail: NTIS CSCL 09/2

The report summarizes the effort expended for the design, implementation, and testing of an interactive graphics testbed to be used in the evaluation of graphics applications for photo interpretation. The system was configured using a mini-computer, digital TV graphics system, TV camera video system, bulk storage, and various operator interactive devices. By using the system an operator can generate a graphic representation of critical data from photography, using the actual photograph, as viewed by the TV camera as a background. These graphic overlays can be stored, combined with text into a report, recalled later for update, or output for hardcopy. The testbed concept allows for collection of critical functional and economic data prior to committing to a full operational system. The project was joint effort involving RADC (IS), ARPA and the Defense Intelligence Agency. The report has been written in sufficient detail to serve as both an operators manual and a report on progress in developing a graphics testbed system for DIA. Author (GRA)

N73-32097# Computer Sciences Corp., Falls Church, Va.
DIGITAL IMAGE MANIPULATION AND ENHANCEMENT SYSTEMS (DIMES). USER'S HANDBOOK
Jun. 1973 152 p
(Contract DAAK02-72-C-0484)
(AD-764280; ETL-CR-73-7) Avail: NTIS CSCL 09/2

The DIMES User's Handbook gives full details of how to use DIMES programs to carry out a series of processing steps on a digitized image which has been stored in a raster format on magnetic tape or disk. DIMES operates on image data by means of a modular library of image manipulation and enhancement programs. The user selects which programs are to operate on the data through a flexible command language. This language also allocates tape and/or disk image files and tranfers user-supplied parameters to each processing routing. This handbook contains an introduction which summarizes the general capabilities of the DIMES system. Next, information is supplied as to how to set up an image processing run deck for execution on the Control Data Corporation (CDC) 6600 computer. CDC control cards are described and the DIMES command language is fully explained. The first section contains descriptions of each task program, including a brief summary, description of inputs and outputs, parameters, restrictions, examples, and timing estimates. Remaining sections describe printer output, special DIMES utility program capabilities, examples of some typical DIMES applications, and a list of DIMES error messages. Author (GRA)

N73-32098# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORK Quarterly Technical Report, 1 Apr. - 30 Jun. 1973
Frank E. Heart Jul. 1973 18 p refs
(Contract F08606-73-C-0027; ARPA Order 2351)
(AD-763734; BBN-2580; QTR-2) Avail: NTIS CSCL 09/2

The ARPA computer network provides a communication medium which allows dissimilar computers (Hosts) to interchange information. Each Host is connected to an Interface Message Processor (IMP), and IMPs are interconnected by leased common carrier circuits. There is frequently no direct circuit between two communicating Hosts, and the intermediate IMPs store and forward the information. IMPs regularly exhange information which is used to adapt routing to changing network conditions. IMPs also report a variety of parameters to a Network Control Center, which coordinates diagnosis and repair of malfunctions. The Terminal IMP (TIP) permits the direct attachment of 63 character-oriented terminals. The Satellite IMP (SIMP) will allow multi-station use of a single earth satellite channel. A High Speed Modular IMP (HSMIMP) is under development; one goal of this effort is to increase IMP performance by an order of magnitude. Specialized mini-Hosts under development will provide for: connection of remote batch terminals; simulation of a leased point-to-point circuit; encrypted Host communication. Author (GRA)

N73-32099# Defense Documentation Center, Alexandria, Va.
COMPUTER-AIDED LOGICAL PROCESSES Report Bibliography, Jan. 1969 - Oct. 1972
Jul. 1973 317 p refs
(AD-764400; DDC-TAS-73-37) Avail: NTIS CSCL 09/2

The bibliography consists of 232 references to reports on Computer-Aided Logical Processes. These were processed in the Defense Documentation Center's data bank, and updates the bibliography previously prepared in December 1968, AD-683600 . The references include research on processes of information handling, pattern recognition, circuit design, computer software, and the application of fundamental mathematical theory to information theory. GRA

N73-32100# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Report, 15 Nov. 1972 - 15 Mar. 1973
Walter R. Goede Jun. 1973 22 p
(Contract DAAB07-72-C-0076; DA Proj. 1S6-62705-A-005) (AD-763933; NORT-72-280-4; ECOM-0072-72-4; QR-4) Avail: NTIS CSCL 09/2

The report describes the progress which occurred during the fourth quarter of a Research and Development contract to develop a 512 x 512 resolution-element display with a resolution of 55 holes-per-inch. This digitally addressed thin display-tube is being developed to evaluate and demonstrate the feasibility of using this display concept to meet Army requirements for a computer-output display. During the fourth quarter the plate fabrication task proceeded with good progress, demonstrating that high-quality plates with 512 x 512 holes at 55 holes-per-inch can be made. Several plates and spacers were made. Some problems were encountered in the envelope fabrication, resulting in returning to the original approach of using two standard curved CRT faceplates as the enclosure with an internal flat phosphor-plate. Good progress was made in the electronics area, and most of the electronics fabrication is completed. Author (GRA)

N73-32101# University of Southern Calif., Marina del Rey.
[COMPUTER PROGRAMMING, ASSURANCE, AND AUTOMATION] Annual Technical Report, 17 May 1972 - 16 May 1973
Keith W. Uncopher May 1973 103 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223-1) (AD-764659; ISI/SR-73-1) Avail: NTIS CSCL 09/2

Research under the contract is oriented toward the application of computer science and technology to problem areas of high impact. The research program is composed of five elements: (1) Programming Research Instrument - the development and exploration of a major time-shared microprogramming facility; (2) Automatic Programming - the study of acquisition and utilization of problem knowledge for program generation; (3) Computer Software Assurance - methods to assess the viability of the security and protection mechanisms of operating system software; (4) Network-Supporting Research - packet-switched network communications technology development including voice, data, and image use in remote conferencing applications; (5) Programmed Automation - the application of computer science technology to automation of DOD high procurement areas, including impact studies and definition of development requirements. Also reported is the development and operation of TENEX computer facilities supporting ARPA-sponsored Institute projects and some 400 external users via the ARPANET. (Modified author abstract) GRA

N73-32102# TRW Systems Group, Redondo Beach, Calif.
AUTOMATIC TRANSFER CHARACTERISTICS MODELING PROGRAM (SYNAP), VOLUME 1 Final Technical Report, 3 May 1972 - 3 Mar. 1973
Brian A. Haas, Eugene J. Mock, and John R. Pistacchi Jul. 1973 140 p ref
(Contract F29601-72-C-0091; DNA Proj. NWED-TC-022) (AD-764809; AFWL-TR-73-51-Vol-1) Avail: NTIS CSCL 09/2

SYNAP (Symbolic Network Analysis Program) is a FORTRAN 4 computer program written for the CDC 6000 series computers. SYNAP generates literal and/or numerical transfer functions and their corresponding response based on a linear circuit topology or signal flowgraph description. The report contains the theory and formulation used in the generation of SYNAP. The structure of the program, its subroutines and various storage schemes are discussed. Also included is a sample problem section illustrating the input and output of the various portions of the program. Author (GRA)

N73-32103# Air Force Academy, Colo. Dept. of Astronautics and Computer Science.
GENERALIZED DATA BASE MANAGEMENT SYSTEMS AND SELECTED AIR FORCE APPLICATIONS Final Report
Anthony J. Winkler, Paul P. Rhymer, Jonathan A. Singer, John A. Lacash, Robert K. Miller, and Karl Starkloff Apr. 1973 173 p refs
(AD-765203; DFACS-73-CS-2) Avail: NTIS CSCL 05/1

The report discusses the generalized data base management systems (GDBMS) with case studies to illustrate the concepts discussed in the tutorial section. An introduction to the functional components of a GDBMS, their interrelationship and their purpose is presented. Data and storage structures and their influence on the GDBMS and its associated operating system are discussed. There is a discussion on the GDBMS user environment and operational considerations. Included also are questions related to the rationale/requirements problem of GDBMSs. The case studies are all Air Force related GDBMSs. Systems discussed are the Headquarters USAF Military Personnel System - System 2.5, the Machine Independent Data Management System (MIDMS), the Program Assisted Concole Evaluation and Review System (PACER), the SACCS Force Management Information System, and the Strategic Air Command Generalized Information System. Author (GRA)

N73-32104# Air Force Academy, Colo. Dept. of Astronautics and Computer Science.
PROCEEDINGS OF THE 3D ANNUAL WORLDWIDE DATA BASE MANAGEMENT SYSTEM SYMPOSIUM Final Report
Anthony J. Winkler and Gordon M. Gerson Jan. 1973 255 p refs Conf. held at AF Acad., Colo., 24-26 Jan. 1973
(AD-765204; DFACS-73-CS-1) Avail: NTIS CSCL 09/2

Contents: An evolutionary approach to the development of data base management systems; Special purpose design - a human factor approach; The Air Force computer selection process; Information systems research for the future; The application of a GDBMS to support the data administrator functions; The ADPS/BLMPS tailored data management system; Data element reconciliation and file structuring technique for MAC's WWMCCS on-line data base; Air Force on-line data system; Status of the system survey team. GRA

N73-32105# Illinois Univ., Urbana. Coordinated Science Lab.
HIGH DENSITY OPTICAL MEMORY Annual Report, 1 Jul. 1972 - 30 Jun. 1973
Jul. 1973 17 p
(Contract N00014-67-A-0305-0015) (AD-765391) Avail: NTIS CSCL 09/2

The continued development of the photochromic memory has resulted in the design and construction of a second generation KCl memory system and an enhancement of the performance

of the original system. Apparatus for coloring memory crystals by means of electron bombardment has been developed making possible the matching of crystal thickness to the depth of field of the focusing lens. Studies of KCl:NaCl properties indicate that thermo-electric cooling units may be used to simplify the cryostat units for housing the crystal. In the immediate future, the control logic will be integrated with the new memory. This will facilitate the storage and retrieval of a large number of bits and allow interfacing the memory with a computer for long term, high speed reliability tests. GRA

N73-32106# Office of Naval Research, Arlington, Va.
COMPUTER SCIENCE IN JAPAN
Richard L. Lau 26 Jun. 1973 13 p refs
(AD-764853; ONR-34) Avail: NTIS CSCL 09/2

During September and October 1972, the writer spent approximately four weeks visiting various Japanese computer scientists and mathematicians and attended the First U.S.A./Japan Computer Conference. This document is partly a report on that trip and partly an attempt at an assessment of the state of the art in various areas of computer science in Japan. Information is incorporated which was gathered on a previous trip to Japan, during the fall of 1971. Also, conversations with various computer scientists in the United States were helpful, particularly a conversation with Dr. Hisashi Wakita of the Speech Communications Research Laboratory, who supplied much of the information reported below on Japanese efforts in speech processing. The trip report was very useful in assessing Japanese efforts in large-scale software systems. GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-32107* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUNDANT SPEED CONTROL FOR BRUSHLESS HALL EFFECT MOTOR Patent
Frank J. Nola, inventor (to NASA) Issued 4 Sep. 1973 8 p Filed 30 Mar. 1972 Supersedes N72-25267 (10-16, p 2134)
(NASA-Case-MFS-20207-1; US-Patent-3,757,183; US-Patent-Appl-SN-239574; US-Patent-Class-318-254; US-Patent-Class-318-328) Avail: US Patent Office CSCL 09E

A speed control system for a brushless Hall effect device equipped direct current (D.C.) motor is described. Separate windings of the motor are powered by separate speed responsive power sources. A change in speed, upward or downward, because of the failure of a component of one of the power sources results in a corrective signal being generated in the other power source to supply an appropriate power level and polarity to one winding to cause the motor to be corrected in speed.
Official Gazette of the U.S. Patent Office

N73-32108* Battelle Memorial Inst., Columbus, Ohio.
PORUS ELECTRODE COMPRISING A BONDED STACK OF PIECES OF CORRUGATED METAL FOIL Patent
John McCallum, inventor (to NASA) Issued 18 Sep. 1973 6 p Filed 22 Mar. 1972 Sponsored by NASA
(NASA-Case-GSC-11368-1; US-Patent-3,759,746; US-Patent-Appl-SN-237029; US-Patent-Class-136-24) Avail: US Patent Office CSCL 09A

An electrode suitable for use in an electrochemical cell is described. The electrode is composed of a porous conductive support with a bonded stack of pieces of thin corrugated nickel foil where the corrugations are oriented approximately perpendicular to the sides of the electrode and form an array of passages through the electrode. Active material such as cadmium hydroxide or nickel hydroxide is uniformly distributed within the passages. The support may comprise also a piece of thin flat nickel foil between adjacent pieces of the corrugated foil, forming a barrier between the passages formed on each side of it. Typically the corrugations in the odd corrugated layers are oriented at a small angle from the perpendicular in one direction and the corrugations in the even corrugated layers are oriented at a small angle from the perpendicular in the opposite direction.
Official Gazette of the U.S. Patent Office

N73-32109* Catholic Univ. of America, Washington, D.C.
ELECTROMAGNETIC WAVE ENERGY CONVERTER Patent
Robert L. Bailey, inventor (to NASA) Issued 18 Sep. 1973 7 p Filed 27 Sep. 1972 Supersedes N73-11205 (11 - 02, p 0149) Sponsored by NASA
(NASA-Case-GSC-11394-1; US-Patent-3,760,257; US-Patent-Appl-SN-292698; US-Patent-Class-321-1.5; US-Patent-Class-136-89; US-Patent-Class-250-212) Avail: US Patent Office CSCL 10A

Electromagnetic wave energy is converted into electric power with an array of mutually insulated electromagnetic wave absorber elements each responsive to an electric field component of the wave as it impinges thereon. Each element includes a portion tapered in the direction of wave propagation to provide a relatively wideband response spectrum. Each element includes an output for deriving a voltage replica of the electric field variations intercepted by it. Adjacent elements are positioned relative to each other so that an electric field subsists between adjacent elements in response to the impinging wave. The electric field results in a voltage difference between adjacent elements that is fed to a rectifier to derive dc output power.
Official Gazette of the U.S. Patent Office

N73-32110* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LIGHTNING TRACKING SYSTEM Patent
Ronald J. Wojtasinski and James H. Jones, inventors (to NASA) Issued 21 Aug. 1973 6 p Filed 28 Jan. 1972 Supersedes N72-27234 (10 - 18, p 2402)
(NASA-Case-KSC-10729-1; US-Patent-3,754,263; US-Patent-Appl-SN-221714; US-Patent-Class-343-112R; US-Patent-Class-343-113R) Avail: US Patent Office CSCL 09E

A system is described for locating lightning strikes by developing the coordinates of a pair of lines, each of which is produced at a reference sensing station. At each station there are a pair of directional antennas which produce analog signals responsive to a lightning stroke. These analog signals are fed to a pair of integrators which integrate the signals for a predetermined period of time so as to produce the X and Y coordinate of a particular line. The analog signals are also fed through a square rooter, a Schmitt trigger circuit, and flip-flops to produce pulses for starting and stopping the integrators. The system at the remote station is similar to that at the central station and is tied to the circuitry at the central station through logic circuits to minimize the chance of error from spurious signals. Computers, printers, and plotters are utilized to plot the exact location of the lightning stroke. Official Gazette of the U.S. Patent Office

N73-32111* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED TUNABLE LASER Patent
Kenneth W. Billman, inventor (to NASA) Issued 14 Aug. 1973 5 p Filed 6 Apr. 1972 Supersedes N72-25268 (10 - 16, p 2134)
(NASA-Case-ARC-10463-1; US-Patent-3,753,148; US-Patent-Appl-SN-241615; US-Patent-Class-331-94.5) Avail: US Patent Office CSCL 09E

A tunable laser apparatus is reported with a first wavelength selective reflector and a second wavelength selective reflector forming one end of an optical cavity, and a third wavelength selective reflector forming the other end of an optical cavity. A first lasable dye solution develops radiation of a wavelength selected by the first reflector and a second lasable dye solution develops radiation of a wavelength selected by the second reflector and a non-linear mixing crystal disposed within the optical cavity. The selected radiation is passed through the nonlinear mixing crystal causing it to develop radiation of a third wavelength which is transmitted out of the optical cavity through the third reflector.
Official Gazette of the U.S. Patent Office

N73-32112* Lockheed Missiles and Space Co., Sunnyvale, Calif.
COAXIAL INVERTED GEOMETRY TRANSISTOR HAVING BURIED EMITTER Patent
Ronald J. Hruby, Steven B. Cress, and William R. Dunn, inventors (to NASA) Issued 18 Sep. 1973 10 p Filed 9 Jun. 1971 Supersedes N71-34214 (09 - 21, p 3403) Sponsored by NASA
(NASA-Case-ARC-10330-1; US-Patent-3,760,239; US-Patent-Appl-SN-151412; US-Patent-Class-317-235R; US-Patent-Class-317-235WW) Avail: US Patent Office CSCL 09A

The invention relates to an inverted geometry transistor wherein the emitter is buried within the substrate. The transistor can be fabricated as a part of a monolithic integrated circuit and is particularly suited for use in applications where it is desired to employ low actuating voltages. The transistor may employ the same doping levels in the collector and emitter, so these connections can be reversed.
Official Gazette of the U.S. Patent Office

N73-32113 Cornell Univ., Ithaca, N.Y.
SILICON SCHOTTKY BARRIER AVALANCHE DIODES Ph.D. Thesis
Robert Ellis Goldwasser 1973 122 p
Avail: Univ. Microfilms Order No. 73-16076

Silicon Schottky barrier avalanche diodes have been fabricated for use as microwave devices without the use of high capacity guard-rings. The devices consist of a platinum silicide barrier on NN(+) epitaxial silicon. The devices have been fabricated utilizing geometrical field reduction and high field platinum diffusion to protect the surface. The devices have yielded 7.5% C.W. dc to RF conversion efficiency in X-band. Subharmonic high efficiency mode pulsed operation has been observed on high punch-through factor devices. A study has been made on the effects of material defects on the device operation. AM and FM noise has been measured and compared to other microwave devices.
Dissert. Abstr.

N73-32114*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION HARDENING OF MOS DEVICES BY BORON Patent Application
Vitaly Danchenko, inventor (to NASA) Filed 4 Sep. 1973 16 p
(NASA-Case-GSC-11425-2; US-Patent-Appl-SN-394206) Avail: NTIS HC $3.00 CSCL 09A

A technique is disclosed for radiation hardening of MOS devices and specifically for stabilizing the gate threshold potential at room temperature. A radiation subjected MOS field effect device of the type having a semiconductor substrate, an insulating layer of oxide on the substrate, and a gate electrode disposed on the insulating layer was used. In the preferred embodiment, the inventive technique contemplates the introduction of boron into the insulating oxide, the boron being introduced within a layer of the oxide of about 100 A to 300 A thickness immediately adjacent the semiconductor-insulator interface. The concentration of boron in the oxide layer is preferably maintained on the order of 10 to the 18th power atoms/cu cm. The technique serves to reduce and substantially annihilate radiation induced positive gate charge accumulations, The accumulations, if not eliminated, would cause shifting of the gate threshold potential of a radiation subjected MOS device, and thus render the device unstable and/or inoperative.
NASA

N73-32115*# ITT Defense Communications Div., Nutley, N.J.
SOLID STATE, S-BAND, POWER AMPLIFIER Final Report
M. Digrindakis Aug. 1973 51 p
(Contract NAS8-28763)
(NASA-CR-124405) Avail: NTIS HC $4.75 CSCL 09E

The final design and specifications for a solid state, S-band, power amplifier is reported. Modifications from a previously proposed design were incorporated to improve efficiency and meet input overdrive and noise floor requirements. Reports on the system design, driver amplifier, power amplifier, and voltage and current limiter are included along with a discussion of the testing program.
Author

N73-32116*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISH ANTENNA HAVING SWITCHABLE BEAMWIDTH Patent Application
Richard F. Schmidt, inventor (to NASA) Filed 10 Sep. 1973 24 p
(NASA-Case-GSC-11760-1; NASA-Case-GSC-11783-1; US-Patent-Appl-SN-395868) Avail: NTIS HC $3.25 CSCL 09E

A switchable beamwidth antenna is described which includes a concave parabolic main reflecting dish with a central circular region and a surrounding coaxial annular region. A feed means selectively excites only the central region of the main dish through a truncated subreflector for wide beamwidth or substantially the entire main dish for narrow beamwidth. In one embodiment, the feed means comprises a truncated concave ellipsoid subreflector and separate feed terminations located at two foci of the ellipsoid. One feed termination directly views all of the main dish while the other feed termination, exciting the main dish through the subreflector, exites only the central region because of subreflector truncation. In another embodiment, the feed means comprises one feed termination and a convex hyperboloid subreflector through which the feed excites the main dish. The subreflector has a fixed central region. Beamwidth switching is effected by retracting the annular region to truncate the subreflector.
NASA

N73-32117*# Philco-Ford Corp., Palo Alto, Calif.
AMPLITUDE STEERED ANTENNA ARRAY Patent Application
George Koboloff, inventors (to NASA), Fred Dietrich, Robert J. Martel, and C. Curtis Johnson Filed 15 Jun. 1972 19 p
(Contract NAS5-21575)
(NASA-Case-GSC-11446-1; US-Patent-Appl-SN-263230) Avail: NTIS HC $3.00 CSCL 09A

An amplitude steered antenna array is presented that will closely approximate the performance of a true electronically steered phased array. The objectives were to steer a high-gain multiple element antenna by means of amplitude variations only, all elements being driven in the same phase and to steer such an array without introducing switching discontinuities. These objectives are achieved by accomplishing antenna element switching during intervals when no power is being applied to the elements being switched. The antenna array comprises a number of elements spaced around the satellite periphery. The array is designed so that when a small group or segment of adjacent elements is excited with RF energy from a common source, the desired radiated beam pattern results. The array is scanned by gradually transferring power from the receding element in the driven segment to the element next to the leading edge of the driven segment. Thus, constant power is applied to the array at all times.
NASA

N73-32118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAGNETIC MATERIALS SELECTION FOR STATIC INVERTER AND CONVERTER TRANSFORMERS
W. T. Mclyman 15 Sep. 1973 43 p refs
(Contract NAS7-100)
(NASA-CR-135642; JPL-TM-33-498-Rev-1) Avail: NTIS HC $4.25 CSCL 09A

A program to study magnetic materials is described for use in spacecraft transformers used in static inverters, converters, and transformer-rectifier supplies. Different magnetic alloys best suited for high-frequency and high-efficiency applications were comparatively investigated together with an investigation of each alloy's inherent characteristics. The materials evaluated were the magnetic alloys: (1) 50% Ni, 50% Fe; (2) 79% Ni, 17% Fe, 4% Mo; (3) 48% Ni, 52% Fe; (4) 78% Ni, 17% Fe, 5% Mo; and (5) 3% Si, 97% Fe. Investigations led to the design of a transformer with a very low residual flux. Tests were performed to determine the dc and ac magnetic properties at 2400 Hz using square-wave excitation. These tests were performed on uncut cores, which were then cut for comparison of the gapped and ungapped magnetic properties. When the data of many transformers in many configurations were compiled the optimum transformer was found to be that with the lowest residual flux and a small amount of air gap in the magnetic material. The data obtained

from these tests are described, and the potential uses for the materials are discussed. Author

N73-32119*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH VOLTAGE PULSE IGNITION OF MERCURY DISCHARGE HOLLOW CATHODES
Edwin G. Wintucky 1973 14 p refs Presented at 10th Elec. Propulsion Conf., Lake Tahoe, Nev., 31 Oct. - 2 Nov. 1973; sponsored by AIAA
(NASA-TM-X-71425; E-7669) Avail: NTIS HC $3.00 CSCL 09A

A high voltage pulse generated by a capacitor discharge into a step-up transformer has been demonstrated capable of consistently igniting hollow cathode mercury discharges at propellant flows and heater power levels much below those required by conventional cathode starting. Results are presented for 3.2-mm diameter enclosed and open keeper cathodes. Starting characteristics are shown to depend on keeper voltage, mercury flow rate, heater power, keeper orifice size, emissive materials, and electrode to which the pulse is applied. This starting technique has been used to start a cathode over 10,000 times without any degradation of starting capability. Author

N73-32120*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALPHANUMERIC CHARACTER GENERATOR FOR OSCILLOSCOPES Patent Application
Donald C. Lokerson and Ronald E. Boston, inventors (to NASA) Filed 14 Sep. 1973 23 p
(NASA-Case-GSC-11582-1; US-Patent-Appl-SN-397477) Avail: NTIS HC $3.25 CSCL 09A

A method and apparatus is disclosed by which any general purpose external trigger laboratory oscilloscope can be utilized to display alphanumeric characters. Each character to be displayed is composed of a plurality of segments appearing at various segment positions in various segment rows to define a conventional matrix, various ones of the segments being displayed during each horizontal sweep of the oscilloscope trace. In between character segments to be displayed the trace is effectively blanked by a vertical clamping voltage so as to position the oscilloscope trace in an off-screen position. The clamping technique of the invention, i.e., biasing the oscilloscope trace to an off-screen position when no character segment is to be displayed, eliminates the necessity of providing Z-axis modulation to effect blanking. NASA

N73-32121*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTRO-MECHANICAL SINE/COSINE GENERATOR Patent Application
Bruce Flagge, inventor (to NASA) Filed 13 Mar. 1973 11 p
(NASA-Case-LAR-11389-1; US-Patent-Appl-SN-340862) Avail: NTIS HC $3.00 CSCL 09A

An electro-mechanical device for generating both sine and cosine functions is reported. A motor rotates a cylinder about an axis parallel to and a slight distance from the central axis of the cylinder. Two noncontacting displacement sensing devices are placed ninety degrees apart, equal distances from the axis of rotation of the cylinder and short distances above the surface of cylinder. Each of these sensing devices produces an electrical signal proportional to the distance that it is away from the cylinder. Consequently, as the cylinder is rotated the outputs from the two sensing devices are the sine and cosine functions. NASA

N73-32122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SIGNAL-TO-NOISE RATIOS IN COHERENT SOFT LIMITERS
J. R. Lesh 15 Sep. 1973 17 p refs
(Contract NAS7-100)
(NASA-CR-135781; JPL-TR-32-1589) Avail: NTIS HC $3.00 CSCL 09A

Expressions for the output signal-to-noise power ratio of a bandpass soft limiter followed by a coherent detection device are presented and discussed. It is found that a significant improvement in the output signal-to-noise ratio at low input SNRs can be achieved by such soft limiters as compared to hard limiters. This indicates that the soft limiter may be of some use in the area of threshold extension. Approximation methods for determining output signal-to-noise spectral densities are also presented. Author

N73-32123# AEG-Telefunken, Frankfurt (West Germany). Forschungsinst.
DEVELOPMENT OF METHODS FOR CONTROL OF CARRIER LIFETIME IN SILICON SLICES [ENTWICKLUNG VON VERFAHREN ZUR GEZIELTEN EINSTELLUNG DER TRAEGERLEBENSDAUER IN SILIZIUMSCHEIBEN]
J. L. Lambert, K. H. Sommer, E. Borchert, and J. Koch Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1973 196 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-t-73-05) Avail: NTIS HC $12.00; ZLDI, Munich 40,75 DM

Control of the carrier lifetime in n-type base regions of gallium diffused power thyristor and diode structures is studied. Scattering of lifetime values after lowering the lifetime by gold diffusion is due to different vacancy generation rates in different silicon crystals. A practical example of gold diffusion technology is discussed and the phosphorus gettering mechanism is studied. High lifetimes can also be obtained by liquid phase diffusion from gallium. Hall effect measurements indicate the concentrations of deep impurities before and after the high temperature processes. A new method of lifetime measurement developed for process control is described. Author (ESRO)

N73-32124# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF DIELECTRIC LAYERS ON SEMICONDUCTOR SUBSTRATES, OBTAINED BY ADDITION OF NEGATIVE RESINS Final Report [ETUDE DE COUCHES DIELECTRIQUES SUR SEMICONDUCTEURS OBTENUES PAR APPORT D'ELECTRORESISTS RAPPORT FINAL]
Jean-Claude Dubois and Maryse Gazard Mar. 1972 64 p refs In FRENCH
(Contract DGRST-70-7-2568-00-221-75-01)
(Rept-5.497) Avail: NTIS HC $5.25

The properties of a negative electrosensitive resin polyvinylsiloxanol upon electronization and thermal treatment are presented and compared to those of classically obtained SiO2. The electric parameters, such as resistivity, dielectric rigidity, and dielectric constant, were measured under a variety of experimental conditions. G(V) characteristics were established for metal-oxide-semiconductor structures yielding the charge numbers in the oxide, and at the interface oxide-semiconductor P/N and N/P junction, diodes were manufactured to show the efficiency of the resin as a diffusion barrier or ion implantation barrier. The SiO2 resulting from the thermal treatment of the resin has properties similar to a medium quality classical SiO2 and is acceptable for semiconductor integrated circuit technology such as MOS circuitry. ESRO

N73-32125# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
RADIOMETRIC AND ELECTRO-OPTICAL APPLICATIONS OF LIQUID CRYSTALS Final Report [APPLICATIONS RADIOMETRIQUE ET ELECTROOPTIQUE DES CRISTAUX LIQUIDES RAPPORT FINAL]
M. Hareng, G. Assouline, A. Dmitrieff, and E. Leiba 30 Dec. 1971 109 p refs In FRENCH
(Contract DGRST-69-01-999-00-212)
(LCR-DR-1-71-223/1/R) Avail: NTIS HC $7.50

The properties of nematic crystals are discussed with relation to the influence of applied tension, temperature, cell geometry, crystal nature and electrolyte doping upon parameters of the dynamic diffusion process such as contrast, time constants, electrical characteristics, and lifetime. Pure commercial products and binary mixtures were investigated. Experimental results are presented showing, under dc excitation, the electric field distribution within the cell and the temperature effect. Remanence effects were studied with regard to decay under tension, and commutation times, with or without applied HF. Image converters with photoconductors are discussed for cells with Se, Se-Te, CdS, ZnO. A CdS converter of surface area 10 x 10 cm,

resolution 5 lp/mm, and threshold sensitivity 0.02 mj/sq cm, is detailed. Other applications such as hard copy reprography, IR and UV converters, and wide screen TV are discussed. Cholesteric liquid crystals were considered for IR visualization and contact nondestructive tests noting the cell homogeneity problem and electric field effects. ESRO

N73-32126# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
ELECTRONIC AND IONIC TECHNIQUES FOR THE DEVELOPMENT OF HIGH RESOLUTION ACTIVE AND PASSIVE DEVICES Annual Report [ETUDE D'UN ENSEMBLE DE TECHNIQUES ELECTRONIQUES ET IONIQUES PERMETTANT LA REALISATION DE DISPOSITIFS ACTIFS ET PASSIFS DE HAUTE RESOLUTION COMPTE RENDU ANNUEL]
O. Cahen, A. Bobenrieth, and A. Dubee 2 Dec. 1971 14 p In FRENCH
(Contract DGRST-68-01-470-01-212-75-01)
(Rept-3.462) Avail: NTIS HC $3.00

A set of electronic and ionic techniques for manufacturing high resolution active and passive solid state devices were studied. An electronic masking instrument was automated yielding, on PMM resin, a minimum slot width of 0.25 micron for contiguous slots separated by one micron. Masking on Cr plates or directly on Si pallets is possible. A new type of negative resin PBE was investigated with electrosensitivity better than 0.000001 C/sq cm. Ionic machining speeds were determined for Zn, Fe, Mo, Ti, and Cr. High frequency cathodic spraying of SiO2 is possible, and the resulting films are adequate for semi-conductor technology. The construction of an ECL gate using bipolar transistors and a DTL gate using field effect transistors with the aim of dissipating less than one picojoule per elementary commutation is discussed. Gates are enclosed in squares of 100 micron side length. Target performances are specified. ESRO

N73-32127# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
MEASUREMENT AND TESTS ON IMAGE DISSECTOR TUBES EMR 549-120 NO. 15357 AND 15358 [ESSAIS ET MESURES SUR LES DISSECTEURS D'IMAGES EMR 549-120 NO. 15357 ET 15358]
Antoine Llebaria 9 Jun. 1972 64 p In FRENCH
(ELEC-010-72) Avail: NTIS HC $5.25

Test and calibration results of an EMR 549-120 image dissector tube are presented. The test program included the verification of factory data, data restitution measurements, and procedures for quality control of further tubes. Photometric and geometric tube properties are discussed with regard to noise, shape and distribution of anodic pulses, relative spectral response from 3500 A to 6000 A. Results are given in tabular and graphical form. ESRO

N73-32128# Army Foreign Science and Technology Center, Charlottesville, Va.
ELECTRICAL EQUIPMENT FOR TROPICAL AND COLD CLIMATES
Vsevolod Vasilevich Maslov 13 Jun. 1973 281 p refs Transl. into ENGLISH of the Mono. "Elektroborudovanie dlya Tropicheskogo i Kholodnogo Klimata" Moscow, Energiya Publishing House, 1971 176 p
(AD-764393; FSTC-HT-23-2249-72) Avail: NTIS CSCL 09/3

Climate factors affecting electrical equipment are characterized for the cold, tropical dry, tropical wet, and tropical marine climates. Categories of electrical equipment are described in design modifications required to function satisfactorily in these climates. Tests and selection of materials and protective coatings for climatized electrical equipment are outlined. Author (GRA)

N73-32129# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AMPLIFICATION OF LOW LIGHT LEVEL OPTICAL SIGNALS BY PREFERENTIAL INTEGRATION IN IMAGING TUBES
Jacob Rotstein and Joseph W. Bielinski 12 Jun. 1973 38 p refs
(Contract F19628-73-C-0002; ARPA Order 600)
(AD-763724; TN-1973-24; ESD-TR-73-171) Avail: NTIS CSCL 09/1

A preferential integration technique is described which permits the selective amplification of low light level signals with a simultaneous suppression of bright signals, optical backgrounds and tube dark currents. This unique technique extends the in frame dynamic range of imaging tubes by over one magnitude with a significant improvement in the threshold sensitivity. Preferential integration permits handling signals as weak as a 0.05 signal to peak-to-peak noise ratio. Improvements of the tubes: modulation transfer function is a direct consequence of the increase in the signal to noise ratio and the suppression of dark levels. The preferential integration technique is applicable to all types of electron beam scanning imaging tubes.
Author (GRA)

N73-32130# Lincoln Lab., Mass. Inst. of Tech., Lexington. 09/5
THEORETICAL ANALYSIS OF A SERIES POWER COMBINING SCHEME FOR MICROWAVE SOLID-STATE AMPLIFIERS
Basrur Rama Rao 10 Jul. 1973 49 p refs
(Contract F19628-73-C-0002; DA Proj. 7X2-63304-D-215)
(AD-764728; TN-1973-25; ESD-TR-73-184) Avail: NTIS

The design and performance analysis of a series power combiner using cascaded stripline or microstrip directional couplers is described. A scattering matrix analysis has been made to determine the frequency response and power combining loss of an 8:1 combiner using stripline directional couplers. The 1-db bandwidth of an 8:1 combiner of this type is approximately 28%. The mid-band ohmic and dielectric losses and the power loading on the various terminations of the couplers have also been determined. It has been shown that this type of series combiner has significant advantages over the Wilkenson-type hybrid combiner both in terms of bandwidth and mid-band loss. However, the series combiner has a narrower bandwidth than the binary-type combiner, but permits the power combination of either odd or an even number of devices. The fabrication of the series combiner also appears to be simpler compared to the binary combiner. Author (GRA)

N73-32131# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A LIGHTWEIGHT, LOW-PROFILE ANTENNA FOR AIRBORNE STATION-KEEPING APPLICATION Physical Sciences Research Papers
William G. Mavroides, Raymond A. Schofield, and Robert J. Mailloux 12 Jan. 1973 27 p
(AF Proj. 4600)
(AD-764685; AFCRL-TR-73-0047; AFCRL-PSRP-527) Avail: NTIS CSCL 09/5

The report describes a low-profile, all dielectric lightweight antenna array to replace the directional antenna for the AN/APN 169 Aircraft Station-Keeping Antenna. The array consists of eight (LEXAN) polycarbonate channel guide elements partially plated with copper enabling the antenna system to be reduced from the present 8 inches in height to less than 2 inches. Design data and radiation patterns are given for the individual elements as well as for the eight-element array. Author (GRA)

N73-32132# Rome Air Development Center, Griffiss AFB, N.Y.
PHOTORESPONSE ANALYSIS OF LINEAR MICROCIRCUIT INSTABILITY RESULTING FROM CHARGE INDUCED SURFACE INVERSION
John R. Haberer May 1973 54 p refs
(AF Proj. 5519)
(AD-764708; RADC-TR-73-65) Avail: NTIS CSCL 09/1

A large number of operational amplifier integrated circuits which had failed in various electronic systems all exhibited the same failure symptoms. The failed devices were electrically unstable and would fail due to a drift of the device offset voltage during use with bias applied. Removal of bias would allow the device to completely recover in most cases. The cycle could be repeated with no apparent change in behavior. Several specialized techniques were applied to analyze these devices in an attempt to identify the specific detailed failure mechanisms. A photoscanning technique developed by the author was applied to identify the direct cause of failure as inversion of the input stage collector load resistor isolation area. This inversion created a conductive channel from the p-type diffused resistors across the n-isolation to the p-substrate. The particular devices found

to be prone to this failure mechanism were those fabricated on (100) oriented silicon. Although it was possible to invert devices fabricated on (111) oriented silicon, in no case did this lead to device failure under normal operating conditions. After having established that inversion was indeed causing device failure, additional analysis was done to establish the exact characteristics of the inversion. (Modified author abstract) GRA

N73-32133# Army Electronics Command, Fort Monmouth, N.J.
INVESTIGATION OF 2 MILLIMETER WAVE IMAGE CONVERSION SYSTEM
Ronald C. Hofer Feb. 1973 52 p refs
(DA Proj. 1S6-62703-A-056)
(AD-765418; ECOM-4035) Avail: NTIS CSCL 09/1

A program of investigation extending previously developed image conversion techniques to 2.15 millimeter wavelength (140 GHz) is described. The key feature of the image conversion system centers around using a novel scheme of conductivity modulation of a semiconductor panel to sample the millimeter wave image. Methods used for the design, construction and calibration of the experimental system are given in detail. Visible displays of millimeter wave images obtained using standard flat metal plates and an armored personnel carrier as object targets over extended ranges of up to 25 meters are presented. A discussion of the results reviews the factors limiting system sensitivity and concludes the sensitivity of the present method is inversely proportional to the square of the number of minimum resolvable elements in the viewing field. Author (GRA)

N73-32134# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARAMETERS OF MAGNETOACOUSTIC CONVERTERS
E. I. Surikova 27 Jul. 1973 13 p ref Transl. into ENGLISH from Tr. Inst. Aviats. Priborostr. (Leningrad), no. 45, 1965 p 81-86
(AD-764935; FTD-HT-23-696-73) Avail: NTIS CSCL 09/1

The report discusses theoretical and experimental studies concerning the effect of structural parameters of a magnetoacoustical converter and its position with respect to the acoustic line on the magnitude and shape of the output signal. GRA

N73-32135# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THERMAL AGING OF SILVER-PLATED COPPER AIRCRAFT ELECTRICAL WIRE Technical Report, Aug. 1971 - Jan. 1973
Lawrence R. Bidwell May 1973 58 p refs
(AF Proj. 7351)
(AD-764731; AFML-TR-73-113) Avail: NTIS CSCL 09/1

FEP/Polyimide insulated silver-plated copper aircraft electrical wire was thermally aged at temperatures of 150-230C for periods of up to 1000 hrs. The wires were examined for evidence that the insulation contributed to strand blocking during high temperature exposure. No evidence for a reaction between the insulation and the metal conductors was found. The phenomenon can be attributed entirely to the interstrand diffusion of silver. Two types of conductor degradation, unrelated to strand blocking, were identified. The nature, possible cause and probable effect of each is discussed and a change in the current temperature rating procedure is recommended. Author (GRA)

N73-32136# Defense Documentation Center, Alexandria, Va.
MICROMINIATURIZATION (ELECTRONICS) Report Bibliography, Feb. 1962 - Feb. 1973
Jul. 1973 298 p refs
(AD-764800; DDC-TAS-73-45) Avail: NTIS CSCL 09/1

The bibliography contains unclassified-unlimited references on Microminiaturization(Electronics). The report presents information on design, development, application and manufacturing methods of electronic components, computers and peripheral equipment. Corporate Author/Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N73-32137# Defense Documentation Center, Alexandria, Va.
CAPACITOR TECHNOLOGY Report Bibliography, Jan. 1962 - Apr. 1973
Jul. 1973 323 p refs
(AD-764825; DDC-TAS-73-46) Avail: NTIS CSCL 09/1

The bibliography is a compilation of unclassified-unlimited references on Capacitor Technology. This report presents information on miniature and microelement capacitors formed by deposition of dielectric substance on a ribbon, sheet, or wafer, and discrete capacitive elements which are found in monolithic or integrated circuits and serve to integrate with other similarly constructed passive and active elements to function as a complete electronic circuit. Corporate Author/Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N73-32138# Northrop Corp., Hawthorne, Calif. Laser Technology Labs.
AREA ELECTRON BEAM EMITTING DEVICE Final Report, 31 May 1972 - 30 May 1973
B. B. OBrien, Jr. Jul. 1973 33 p refs
(Contract N60921-72-C-0334)
(AD-764952; NRTC-73-29R) Avail: NTIS CSCL 09/1

One method of stabilizing high pressure CO2 and CO laser gas discharges is that of producing the ionization by an electron beam. An electron beam source is described which does not use a thermionic emitter but rather secondary emission from a cathode in a low pressure gas discharge. The work was primarily directed toward understanding a plasma discharge which will produce electron energies up to 150 kV and electron current densities up to 1 A/sq cm for durations of the order of 20 microseconds. For voltages up to about 120 kV a pulse duration of 100 microseconds or longer is attainable without arcing. GRA

N73-32139# Washington Univ., Seattle. Dept. of Electrical Engineering.
DOUBLE SPHERICAL CASSEGRAIN REFLECTOR WITH A SINGLE DISPLACED FEED
Akira Ishimaru, Vincent K. Wong, and H.-K. Tsiang Mar. 1973 55 p refs
(Contract F19628-71-C-0112; AF Proj. 4600)
(AD-764778; TR-162; AFCRL-TR-73-0196; SR-3) Avail: NTIS CSCL 09/1

For multibeam operation of an antenna, it is necessary for some of the feeds to be displaced from the axis of symmetry. The effects of such displacement are investigated for the double-spherical Cassegrain reflector. Aperture blocking, phase error, radiation pattern, aperture efficiency, beam-width and sidelobe level are studied as functions of the displacement angle xi. An attempt to improve the performance of the antenna by tilting the feed through an angle zeta is made, and a practical feed pattern is used to evaluate the system. The results indicate that very narrow beamwidth and reasonably low sidelobes can be obtained, which are essential for multibeam antennas. The decrease of the aperture efficiency due to a displacement and a tilt of the feed is studied in detail for different reflector sizes and feed pattern. Author (GRA)

N73-32140# Illinois Univ., Savoy. Aviation Research Lab.
DESIGN OF A DIGITAL COMPUTER DRIVEN CATHODE-RAY-TUBE DISPLAY SYSTEM M.S. Thesis
Robert Luis Hoolko May 1973 40 p refs
(Contract F44620-70-C-0105; AF Proj. 9778)
(AD-764762; ARL-73-11/AFOSR-73-7; AFOSR-73-1259TR)
Avail: NTIS CSCL 01/3

A digital computer-driven-cathode-ray-tube display system which can be used in a ground-based flight simulator had to be designed. The requirements of the system are discussed, and several approaches to the problem are considered. Reasons are given for the approach selected, the circuitry used is described, and the performance of the display system is evaluated. Author (GRA)

N73-32141# Joint Army-Navy Aircraft Instrumentation Research Project, Washington, D.C.
COCKPIT SWITCHING STUDY: LOGIC AND DESIGN PROCEDURE DEVELOPMENT FOR MULTIFUNCTION MODE SWITCHING CONTROLS Final Report
D. K. Graham May 1973 76 p refs
(Contract N00014-72-C-0191; NR Proj. 213-088)
(AD-764617; D180-15335-1; JANAIR-730501) Avail: NTIS

CSCL 09/1

The purpose of the cockpit switching study was to develop a procedure for design and application of multifunction switching concepts to cockpit controls, and thereby reduce both the number of cockpit switches required and the switching workload of the pilot or aircrew. Such a procedure was developed and is printed under separate cover in a self-guiding handbook format. The procedure is a logical, step-by-step method of consolidating many switching functions on relatively few multifunction switches. The procedure handbook includes appendices containing a review of multifunction switching hardware, and human-engineering design considerations. (Modified author abstract) GRA

N73-32142# Naval Aerospace Medical Research Lab., Pensacola, Fla.

TECHNIQUE FOR REDUCING THE AMBIENT ELECTRIC FIELD GENERATED BY INDUCTIVE VOLTAGES IN LOW FREQUENCY MAGNETIC FIELD GENERATORS

James D. Grissett 5 Apr. 1973 18 p refs

(AD-764531; NAMRL-1177) Avail: NTIS CSCL 14/2

U.S. Navy interest in the physiological effects of nonionizing radiation in the extremely low-frequency (ELF) range has led to the construction of research facilities in which various life forms can be exposed and their physiological responses to these fields monitored. The magnetic component is generated by a coil system in resonance with a capacitor bank. The inductive voltage drop across the system is sufficient to generate a high electric field between the coil sections. This electric field is undesirable because it does not allow effects of the magnetic field to be separated from effects of the electric field. The undesirable electric field component can be minimized by breaking each section at its center. These subsections can then be connected with the capacitors in such a way that the electric field generated by each coil segment is canceled by the electric field generated by another segment of the same coil. Several different arrangements will accomplish the desired cancellation. The pros and cons of each arrangement are a function of the required number of capacitors and the voltage levels on the interconnecting cables. Very large coils producing high magnetic fields can be constructed in this manner. (Modified author abstract) GRA

N73-32673 Joint Publications Research Service, Arlington, Va.

THE DEVELOPMENT OF STRUCTURAL METHODS FOR INCREASING THE EFFECTIVENESS OF FULLY ROTATABLE PARABOLIC ANTENNAS

A. G. Sokolov and V. S. Polyak *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 6-13 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 655-660 (For availability see N73-32671 23-30)

N73-32675 Joint Publications Research Service, Arlington, Va.

METHOD OF ALIGNMENT AND TECHNOLOGY OF FABRICATING RTI-7.5/250 MVTU RADIOTELESCOPE ANTENNAS

A. A. Parshchikov, B. A. Rosanov, V. S. Sagatelov, and A. A. Tanygin *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 19-22 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 665-668 (For availability see N73-32671 23-30)

N73-32676 Joint Publications Research Service, Arlington, Va.

PARAMETERS OF THE RT-22 KrAO RADIOTELESCOPE ANTENNA AT WAVELENGTHS OF 3 AND 1.35 CENTIMETERS

L. D. Bakhrakh, M. I. Grigoryeva, V. A. Efanov, L. R. Kogan, V. I. Kostenko, L. I. Matveyenko, I. G. Moiseyev, and Yu. G. Monin *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 23-29 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 675-679 (For availability see N73-32671 23-30)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-32143* Massachusetts Inst. of Tech., Cambridge.

TRANSPARENT SWITCHBOARD Patent

Hans P. Rasmussen, inventor (to NASA) Issued 11 Sep. 1973 11 p Filed 15 Feb. 1972 Supersedes N72-20240 (10 - 11, p 1450) Sponsored by NASA

(NASA-Case-MSC-13746-1; US-Patent-3,758,718; US-Patent-Appl-SN-226476; US-Patent-Class-178-18) Avail: US Patent Office CSCL 09C

A tin oxide coating is formed on a plate of glass and the coating is then etched away from the glass in thin lines to form separate electrical conductors which extend to one end of the plate and connect to either a vertical (column) or horizontal (row) position sensing SCR circuit. A thin transparent insulating coating is formed over the oxide layer except at selected touch points which are positioned in a matrix pattern of vertical columns and horizontal rows. Touching one of these points with a finger bridges the thin line between adjacent conductors to activate trigger circuits in the particular row and column sensing circuits associated with the point touched. The row and column sensing circuits are similar and are powered with a low frequency, ac voltage source. The source for the row circuits is 180 out of phase with the source for the column circuits so that one circuit acts as ground for the other during half of the supply voltage cycle. The signals from the sensing circuits are input to a logic circuit which determines the presence of a valid touch, stores a binary matrix number associated with the touched point, signals a computer of the presence of a stored number and prevents storage of a new number before receiving an enable signal from the computer. Official Gazette of the U.S. Patent Office

N73-32144* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

EVENT SEQUENCE DETECTOR Patent

Michael F. Hanna, inventor (to NASA) Issued 18 Sep. 1973 10 p Filed 4 Feb. 1972 Supersedes N72-22238 (10 - 13, p 1721) Sponsored by NASA

(NASA-Case-NPO-11703-1; US-Patent-3,760,394; US-Patent-Appl-SN-223560; US-Patent-Class-340-223; US-Patent-Class-340-166; US-Patent-Class-340-173; US-Patent-Class-340-415) Avail: US Patent Office CSCL 09C

An event sequence detector is described with input units, each associated with a row of bistable elements arranged in an array of rows and columns. The detector also includes a shift register which is responsive to clock pulses from any of the units to sequentially provide signals on its output lines each of which is connected to the bistable elements in a corresponding column. When the event-indicating signal is received by an input unit it provides a clock pulse to the shift register to provide the signal on one of its output lines. The input unit also enables all its bistable elements so that the particular element in the column supplied with the signal from the register is driven to an event-indicating state.

Official Gazette of the U.S. Patent Office

N73-32145* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INDUCTION MOTOR CONTROL SYSTEM WITH VOLTAGE CONTROLLED OSCILLATOR CIRCUIT Patent

Frank J. Nola, James R. Currie, and Harry Reid, Jr., inventors (to NASA) Issued 18 Sep. 1973 7 p Filed 19 Jan. 1972 Supersedes N72-20232 (10 - 11, p 1449)

(NASA-Case-MFS-21465-1; US-Patent-3,760,248; US-Patent-Appl-SN-218965; US-Patent-Class-318-230; US-Patent-Class-307-271; US-Patent-Class-318-231; US-Patent-Class-318-341; US-Patent-Class-331-135) Avail: US Patent Office CSCL 09C

A voltage controlled oscillator circuit is reported in which there are employed first and second differential amplifiers. The first differential amplifier, being employed as an integrator, develops equal and opposite slopes proportional to an input voltage, and the second differential amplifier functions as a comparator to detect equal amplitude positive and negative selected limits and provides switching signals which gate a transistor switch. The integrating differential amplifier is switched between charging and discharging modes to provide an output of the first differential amplifier which upon the application of wave shaping provides a substantially sinusoidal output signal.

A two phased version with a second integrator provides a second 90 deg phase shifted output for induction motor control.
Official Gazette of the U.S. Patent Office

N73-32146# University Coll. of North Staffordshire, Keele (England). Dept. of Physics.
FURTHER STUDIES ON SECONDARY ELECTRON EMISSION Annual Report
E. B. Pattinson, M. Suleman, and B. Wright Dec. 1972 40 p refs Sponsored by Min. of Defence
(RU-20-6) Avail: NTIS HC $4.00

The production of a low yield metal black surface is reported that is capable of withstanding prolonged heat treatments up to a temperature of 950 C and still retain its low yield properties, i.e., such that vacuum brazing can be employed on such a treated surface. In addition Auger electron spectroscopy of magnesium and iron in the low energy region is reported. Author

N73-32147# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
CALCULATION OF EVANESCENT-WAVE GAIN IN THE TE SUB Om AND TM SUB Om MODES OF AN OPTICAL FIBRE
A. Watanabe, K. O. Hill, and D. Mintz Jul. 1973 20 p refs
(CRC-1247) Avail: NTIS HC $3.00

The previous perturbation-theory treatment of evanescent-wave gain in dielectric slabs is extended to the case of a cylindrical dielectric waveguide for optical fiber. The general formalism for treating evanescent-wave gain due to an active cladding material is developed, and detailed calculations of the gain coefficient ratio are presented for the TE sub Om and TM sub Om modes of the active optical fiber. Author

N73-32148*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF RESPONSIVITY AND NOISE IN A DIRECT-COUPLED PHOTODETECTOR-PREAMPLIFIER FOR FACSIMILE CAMERAS
W. Lane Kelly, IV and Stephen J. Katzberg Washington Oct. 1973 25 p refs
(NASA-TN-D-7338; L-9000) Avail: NTIS HC $2.75 CSCL 09E

The direct-coupled (DC) mode of detector operation is evaluated for use in a facsimile camera. Photodiode-preamplifier sensitivity is described in terms of photodiode responsivity and possible noise sources resulting from the photodiode and preamplifier. Responsivity and noise limitations are experimentally verified and used to predict photodiode-preamplifier sensitivity under a wide range of operating conditions. Results demonstrate that the DC mode offers advantages in sensitivity and reduced mechanical complexity for facsimile cameras over the more common technique of chopping the radiation and ac amplifying the resultant signal. Author

N73-32149# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
BASILE: PROGRAM FOR LOGIC CIRCUIT SIMULATION [BASILE: PROGRAMME DE SIMULATION DE CIRCUITS LOGIQUES]
A. Escourrou Jan. 1973 11 p In FRENCH
(LAAS-SL-73-I-08) Avail: NTIS HC $3.00

A digital simulation program for logic circuits written in PI/1 language and reading format LIST is presented. A three level Boolean simulation is used. The temporal simulation uses shell propagation of logical levels with equal rise and fall delay times for all gates. The circuit is described by its topological matrix, and various types of excitation vectors may be introduced. Initialization sequences or static random situations using the Eichelberger method are available. The program flow chart is given and initialization sequences detailed. An example is given for a specific circuit. ESRO

N73-32150# Army Electronics Command, Fort Monmouth, N.J.
IMPROVED NON-LINEAR DIELECTRICS FOR ELECTRONIC TUNING
Howard Wichansky Aug. 1973 37 p refs
(DA Proj. 1T7-62705-A-348)
(AD-765417; ECOM-4138) Avail: NTIS CSCL 09/1

The efforts to develop non-linear dielectrics, ferroelectric barium strontium titanate, as voltage variable capacitors for lightweight, VHF electronic tuning in antenna matching and jamming applications are described. Using a variety of sintering schedules during kiln-firing and during hot-pressing, a wide variation in the micro-structure of the ceramics was developed. The strong influence of the grain size of barium strontium titanate on the permittivity ratio, the variation of permittivity with superimposed dc bias, is presented as a function of temperature. A 10-fold decrease in permittivity with 80 v/mil dc bias was obtained at the Curie temperature of a ceramic with coarse grains. The mechanisms responsible for the field dependent change in permittivity, namely a field induced paraelectric to ferroelectric transition and a domain alignment process, are re-examined in the light of recent findings stressing the influence of microstructure. The frequency response of dissipation factor is also included along with the proposed mechanisms that account for the observed behavior. Satisfactory performance of the non-linear dielectrics in tuning devices is possible within a constant temperature environment and a frequency range of 3 to 30 MHz. Author (GRA)

N73-32151# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
SELF-CHECKING OF MULTI-OUTPUT COMBINATIONAL CIRCUITS USING FORCED-PARITY TECHNIQUE Ph.D. Thesis
Danny Chih-Chun Ko Jun. 1973 160 p refs
(Contract N00014-67-A-0269-0019; Grant NSF GK-23886; NR Proj. 048-299)
(AD-765037; USCEE-451) Avail: NTIS CSCL 09/2

One integral part of a self-checking system is an appropriate error detecting circuit. The error signal provided can be used to stop computation, signal for manual repair, or initiate automatic reconfiguration. In the report error detecting schemes for combinational circuits are investigated from the hardware redundancy viewpoint. It is well-known that any circuit can be checked by the technique of complete duplication. The redundancy ratio obtained is higher than 2:1. The technique presented in this dissertation is called Forced-Parity Checking. Its concept is derived from conventional parity checking technique which is applicable only for odd numbers of errors, yet it can detect errors of any degree. Since some circuits lend themselves to be checked more efficiently by one technique than by another, this technique is by no means expected to achieve a low redundancy ratio for every circuit. The main objective is to generalize and formalize a design procedure which, when applied to a circuit, may yield a redundancy ratio below the known lower bound. (Modified author abstract) GRA

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-32152* Douglas Aircraft Co., Inc., Santa Monica, Calif.
COLLAPSIBLE PISTONS Patent
Robert N. Teng, inventor (to NASA) Issued 9 Oct. 1973 6 p Filed 27 Jul. 1971 Supersedes N72-11271 (10 - 02, p 0184) Sponsored by NASA
(NASA-Case-MSC-13789-1; US-Patent-3,763,740; US-Patent-Appl-SN-166487; US-Patent-Class-89-8; US-Patent-Class-102-95; US-Patent-Class-188-1C) Avail: US Patent Office CSCL 14B

A piston assembly is described for use in a hypervelocity gun comprising a forward cylindrical section longitudinally spaced from a rearward cylindrical section by an intermediate section. The intermediate section is longitudinally collapsible when subjected to a predetermined force, to allow the distance between

the forward and rearward sections to be suddenly reduced.
Official Gazette of the U.S. Patent Office

N73-32153 Purdue Univ., Lafayette, Ind.
THE APPLICATION OF ENERGY CONCEPTS TO PAVEMENTS Ph.D. Thesis
William Henry Highter 1972 178 p
Avail: Univ. Microfilms Order No. 73-15817

Pavement engineers have not been able to predict the performance of pavement systems prior to their actual construction and operational utilization. A solution to this problem was obtained by verifying the following hypothesis: There is a functional relationship between the cumulative energy as measured by cumulative peak deflections imparted to a given pavement system and the condition of that system. The hypothesis was tested by applying it to load-deflection and performance trend data gathered in the AASHO Road Test. Regression analysis was performed to find a relationship that predicted the level of the Present Serviceability Index (PSI) as a function of the pavement profile and a measure of the cumulative energy imparted to the pavement. Because of the paucity of airfield condition and deflection data, indirect means had to be used to test the working hypothesis for airfield pavement. Traffic records and construction histories for two Air Force Bases were analyzed. The analysis indicated there is a threshold cumulative total peak deflection at which cracking develops in airfield pavements.
Dissert. Abstr.

N73-32154*# Biospherics, Inc., Rockville, Md.
AUTOMATED MICROBIAL METABOLISM LABORATORY Annual Report 1973
Jul. 1973 164 p refs
(Contract NASw-2280)
(NASA-CR-135638) Avail: NTIS HC $10.25 CSCL 14B

Development of the automated microbial metabolism laboratory (AMML) concept is reported. The focus of effort of AMML was on the advanced labeled release experiment. Labeled substrates, inhibitors, and temperatures were investigated to establish a comparative biochemical profile. Profiles at three time intervals on soil and pure cultures of bacteria isolated from soil were prepared to establish a complete library. The development of a strategy for the return of a soil sample from Mars is also reported.
Author

N73-32155# McDonnell-Douglas Electronics Co., St. Charles, Mo.
SYNCHRONIZATION STATION LOCATION STUDY METHODOLOGY DEVELOPMENT, PHASE 1 Final Report, Oct. 1972 - May 1973
J. M. Holt, F. D. Watson, and C. J. Neumann Jul. 1973 218 p refs
(Contract DOT-FA73WA-3172)
(FAA-RD-73-102) Avail: NTIS HC $13.00 CSCL 14B

A technology for evaluating ground station sites on the basis of their effectiveness in disseminating time synchronization was produced. Operation of major U.S. scheduled aircarrier aircraft operating in CONUS were modeled; for a given day and time-of-day, the altitude, latitude and longitude of each aircraft is computed. Then, air-to-air and air-to-ground communication linkages are determined. In addition to producing data for use by the computer, these processes produce maps of aircraft activity versus time of day for direct interpretation. Provisions were made to include the time-user needs of general aviation and military aircraft. With appropriate effectiveness equations, a computer implemented algorithm determines the strategy and trade-offs in site selection for ground based time disseminating equipment.
Author

N73-32156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCENE ANALYSIS FOR A BREADBOARD MARS ROBOT FUNCTIONING IN AN INDOOR ENVIRONMENT
Martin D. Levine 1 Sep. 1973 45 p refs
(Contract NAS7-100)
(NASA-CR-135711; JPL-TM-33-645) Avail: NTIS HC $4.25 CSCL 14B

The problem is dealt with of computer perception in an indoor laboratory environment containing rocks of various sizes. The sensory data processing is required for the NASA/JPL breadboard mobile robot that is a test system for an adaptive variably-autonomous vehicle that will conduct scientific explorations on the surface of Mars. Scene analysis is discussed in terms of object segmentation followed by feature extraction, which results in a representation of the scene in the robot's world model.
Author

N73-32157*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE SHOCK TUBE AS A TOOL FOR DYNAMIC TESTING OF FABRICS
Richard Madden, Anthony R. Clemente, and James D. Blackwell [1973] 32 p refs
(Contract NAS1-10024)
(NASA-CR-132284) Avail: NTIS HC $3.75 CSCL 14B

Specimens of fabric and Mylar were loaded to failure both statically and dynamically. Static tests were accomplished by pressurizing the specimens and dynamic tests were conducted by firing a shock tube. The results of the study incicate that seam efficiency is degraded by dynamic loads and that a need exists to investigate a seaming procedure which gives an optimum dynamic efficiency. The study also illustrates the lack of correspondence between static and dynamic breaking strengths thereby indicating that fabrics which have dynamic applications should be evaluated using dynamic testing procedures such as the shock tube loading used in the present program.
Author

N73-32158# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE S-4 MODANE HYPERSONIC WIND-TUNNEL: ITS USE FOR AIR BREATHING ENGINE TESTS
Jean Laverre and Christian Soulier [1973] 10 p refs In FRENCH; ENGLISH summary Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $3.00

The S4-MA hypersonic wind tunnel is equipped with a Mach 6 nozzle, working at maximum stagnation conditions of 40 bars and 1650 K. The diameter of the free jet test section is 0.68 m. The possibilities offered by the high pressure and temperature air supply system were used for studying the operation of a ramjet supersonic combustion chamber, fed with hydrogen, in the flight conditions. The Mach 6 nozzle was replaced by a duct of appropriate shape, directly connected to the annual intake. Apart from this type of test in closed duct, the wind tunnel permits, with its Mach 6 nozzle, the study of the aerodynamic behavior of large size air intakes, under the actual flight conditions of pressure and temperature. The model may be set in pitch and/or yaw, up to plus or minus 15 deg. The study of a complete airbreathing engine, with its intake and diffusor and with actual flight conditions (Mach 6, 25 km altitude) at intake is possible. The downstream conditions are obtained by using an adequate exhaust system for the combustion gases, either towards spherical vacuum tanks (4000 or 5000 cu m at 0.02 bar) or to atmosphere through a compressed air ejector.
Author

N73-32159# Minister fuer Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein, Westfalen (West Germany).
TASKS OF REGIONAL AIRPORTS AND RESULTING GROUND FACILITIES REQUIREMENTS [AUFGABEN DER REGIONALFLUGPLAETZE; DARAUS RESULTIERENDE ANFORDERUNGEN UND DIE BODENANLAGEN]
G. Ruff 1973 14 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(DGLR-Paper-73-035) Avail: NTIS HC $3.00

The role of regional airports is described, and the requirements for ground facilities are surveyed from a sociological and economic point of view.
ESRO

N73-32160# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
D2B CALIBRATION OF VACUUM CHAMBER EQUIPMENT [D2B CALIBRATIONS EQUIPMENT DES CUVES A VIDE]
17 Feb. 1972 12 p In FRENCH
(OPT-005-72) Avail: NTIS HC $3.00

The characteristics of optico-mechanical test equipment for D2B satellite vacuum chamber calibration down to 1200 A are

given. They include light sources, focalization boxes, filter and star boxes, calibration boxes monochromators, photomultiplier, collimator and lens. Interfaces, tasks, procedures, and schedules are specified. ESRO

N73-32161# Calspan Corp., Buffalo, N.Y.
SELF-CORRECTING WIND TUNNELS
W. R. Sears Jul. 1973 48 p refs
(Contract N00014-72-C-0102; NR Proj. 061-199)
(AD-764957; CALSPAN-RK-5070-A-2) Avail: NTIS CSCL 14/2

The familiar technique of accounting for wind-tunnel boundary effects by correcting measured data fails in some of the most important flight regimes, such as the transonic and V/STOL. In such domains, typically strongly nonlinear, it seems necessary that the wind tunnel provide the same flow conditions in the vicinity of the model as in flight, since corrections are virtually impossible. Present-day slotted and perforated tunnels, for example, are intended to do this, but are often inadequate. However, unconfined flow is characterized by certain functional relationships among the flow variables at points on a surface within the tunnel; it is always possible to ascertain whether unconfined-flow conditions are actually present, by measuring such quantities and verifying that these relationships are indeed satisfied. These relationships are independent of the configuration being tested. It is proposed here that wind tunnels be provided with sensors to measure such selected quantities on a convenient surface and means to vary wall geometry so as to approach such conditions in an iterative process. (Modified author abstract) GRA

N73-32162# Illinois Univ., Savoy. Aviation Research Lab.
A DIGITAL COMPUTER-GENERATED CONTACT ANALOG LANDING DISPLAY
Terry L. Hummel May 1973 92 p refs
(Contract F44620-70-C-0105)
(AD-764764; ARL-73-9/AFOSR-73-5; AFOSR-73-1258TR)
Avail: NTIS CSCL 17/7

A flexible display device was constructed to present a visual landing and navigation display to a pilot. The device makes use of a small digital computer, a flight simulator, and display equipment. A contact analog visual representation of external world objects plus control information is displayed to the pilot. The system is capable of simulating a nighttime approach to an airport and various types of enroute visual information.
Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-32163 Yale Univ., New Haven, Conn.
THE EFFECT OF SURFACE TENSION ON THE RISING VELOCITY OF A CYLINDRICAL GAS SLUG Ph.D. Thesis
Kie Wei Tung 1972 98 p
Avail: Univ. Microfilms Order No. 73-16405

The effect of surface tension on the velocity of a gas slug rising in a long, vertical, cylindrical tube is studied. A series solution is used in the calculation of the final result. However, preceding the final computation, first the truncation of the series solution is justified by a source distribution representation of the solution. Then, the non-uniqueness of the solution defined by the application of the Bernoulli equation along the bubble interface is demonstrated. This non-uniqueness leads to the development of additional closure conditions in the form of an extremum principle based on the idea of minimizing potential energy. A mathematical model employing the extremum condition is then constructed for the calculation of the surface tension effect. Dissert. Abstr.

N73-32164 California Inst. of Tech., Pasadena.
VISCOUS EFFECTS IN INCEPTION AND DEVELOPMENT OF CAVITATION ON AXI-SYMMETRIC BODIES. PART 1: CAVITATION INCEPTION. PART 2: A SEMI-EMPIRICAL METHOD TO PREDICT CAVITATION SEPARATION ON SMOOTH BODIES Ph.D. Thesis
Vijay Hanumappa Arakeri 1973 167 p
Avail: Univ. Microfilms Order No. 73-14300

The schlieren method was developed as a flow visualization technique for use in water tunnels. The process of cavitation development on two axi-symmetric bodies was studied using this approach and found to be greatly influenced by the presence of a previously unreported viscous laminar separation. On these bodies, cavitation inception was observed to take place within this separated region which occurs far downstream of the minimum pressure point. Cavitation separation under fully developed conditions is found to be preceded by a viscous laminar boundary layer separation on bodies which possess the latter separation under fully wetted conditions. An empirical method is proposed to compute the position of cavitation separation on such bodies. Dissert. Abstr.

N73-32165 Cincinnati Univ., Ohio.
AN ANALYTICAL SOLUTION OF THE COMPRESSIBLE MOMENTUM AND THERMAL BOUNDARY LAYER WITH PRESSURE GRADIENT AND CONTINUOUS OR LOCAL COOLANT MASS INJECTION Ph.D. Thesis
Roointon E. Pavri 1972 159 p
Avail: Univ. Microfilms Order No. 73-16367

An analytical solution of the nonsimilar laminar boundary layer with pressure gradient, variable wall temperature and with continuous or local mass injection is reported. The method consists of transforming the partial differential equations for momentum and enthalpy and then solving the transformed equations by assuming polynomial stream function and enthalpy profiles. Solutions obtained show excellent agreement with exact numerical results and with existing, limited applicability analytical methods. Dissert. Abstr.

N73-32166 Iowa State Univ. of Science and Technology, Ames.
NUMERICAL CALCULATION OF FLOW FIELDS ABOUT RECTANGULAR WINGS OF FINITE THICKNESS IN SUPERSONIC FLOW Ph.D. Thesis
Jerald Milo Vogel 1973 178 p
Avail: Univ. Microfilms Order No. 73-16985

The inviscid flow fields about a three dimensional rectangular wing of finite thickness at angle of attack with a subsonic tip in a supersonic flow are determined by applying a second order finite difference technique to the gas dynamic equations of motion in their conservative form. The analysis includes a comparison of the second order technique with a current third order method. Dissert. Abstr.

N73-32167 Purdue Univ., Lafayette, Ind.
APPLICATIONS OF WIENER-HERMITE EXPANSION TO THE THEORIES OF TURBULENCE Ph.D. Thesis
Johnson Chong-Tsun Wang 1972 95 p
Avail: Univ. Microfilms Order No. 73-15883

The applications are studied of the Wiener-Hermite expansion to the statistical theories of hydrodynamical turbulence. The fine structure and energy decay for both Burgers model turbulence and real turbulence governed by Navier-Stokes equations are investigated. For the real turbulence, the statistical homogeneity and isotropy are assumed. The turbulent velocity is expanded in terms of the polynomial combinations of the white noise function. The first of the expansion is Gaussian. The succeeding terms represent corrections to the Gaussian. Since the experimental results reveal that the distribution of the velocity fluctuation at one point in the turbulent field is nearly Gaussian, we take only the first two terms of the expansion. The dynamical equations governing the turbulent field are, then, reduced to a set of deterministic differential integral equations. Solving the set of differential integral equations, in the equilibrium inertial subrange, an energy spectrum is obtained for the homogeneous isotropic turbulence. This result is consistent with Kolomogoroff's law. Dissert. Abstr.

N73-32168 New Mexico State Univ., University Park.
A GENERALIZED MOMENTUM TRANSFER HYPOTHESIS FOR NON-NEWTONIAN POWER-LAW FLUIDS Ph.D.

Thesis
Abdul Ilah Y. Mohammed 1973 90 p
Avail: Univ. Microfilms Order No. 73-16943

A generalized momentum transfer hypothesis, similar to that of Prandtl, is developed to estimate the non-Newtonian Reynolds stresses in turbulent flow. This development is applicable only to non-Newtonian fluids which may be characterized by the power-law stress-rate of strain model. According to this hypothesis, the turbulent velocity fluctuations of non-Newtonian power-law fluids may be expressed in a form analogous to their laminar shear stress-rate of strain relationship provided that a non-Newtonian Reynolds stress parameter is incorporated into the expression to render it dimensionally homogeneous. This parameter is conveniently represented by the product of a dimensionless non-Newtonian Reynolds stress coefficient, K sub n, and the friction velocity. The resulting expression for the Reynolds stresses in a circular conduit is given. The entire expression reduces to Prandtl's expression for Newtonian fluids when n = 1. The general equation for axisymmetric turbulent flow in smooth conduits is developed based on the principle of a single continuous layer. This principle asserts that while the relative magnitude of the viscous and Reynolds stresses may vary depending on the region in the flow field, both are nevertheless operative througout the flow. Dissert. Abstr.

N73-32169 Rhode Island Univ., Kingston.
AN INTEGRAL METHOD FOR ANALYZING TWO DIMENSIONAL AND AXISYMMETRIC COMPRESSIBLE AND THREE DIMENSIONAL INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS Ph.D. Thesis
George Henry Christoph 1972 129 p
Avail: Univ. Microfilms Order No. 73-16329

The method utilizes law-of-the-wall velocity and temperature correlations in the integration of the continuity, momentum, and energy equations across the boundary layer. The results are differential equations for the skin friction coefficient, the Stanton number, and the tangent of the angle between the total surface shear stress vector and the shear stress in the freestream direction. No integral thicknesses and shape factors need be calculated. The method compares favorably with other existing theories and with two-dimensional and axisymmetric compressible experimental data and three-dimensional incompressible experimental data.
Author

N73-32170 Missouri Univ., Rolla.
AN ANALYTICAL STUDY OF A CONFINED VISCOUS VORTEX Ph.D. Thesis
David Edward Crow 1972 169 p
Avail: Univ. Microfilms Order No. 73-17066

A composite solution for the flow field of a three dimensional, incompressible, laminar, viscous vortex confined inside a conical converging nozzle is presented. This model is used to study the strong mainstream boundary layer interaction that occurs in confined vortex flows. The confined vortex flow field is divided into mainstream and boundary layer regions. A particular class of solutions of the general equations of motion is used to represent the vortex flow in the mainstream region. The results for the velocity profiles and the boundary layer growth obtained by separately considering each region of the flow field are presented and discussed. Dissert. Abstr.

N73-32171 Cornell Univ., Ithaca, N.Y.
NEARLY SPHERICAL CONSTANT POWER DETONATION WAVES DRIVEN BY FOCUSED RADIATION Ph.D. Thesis
Yves Henri George 1973 101 p
Avail: Univ. Microfilms Order No. 73-16073

The shape and the inner flow of a tridimensional spark created by focusing a laser beam in a gas are studied. The radiation is absorbed in a narrow layer preceded by a shock wave. The flow of inside plasma is assumed to be perfect gas, non-viscous and non-heat conducting; thermal reradiation can be neglected. Self-similarity is demonstrated for zero counterpressure and constant laser power in time; the time exponent is 3/5. An angular perturbation of a spherical spark is introduced by modifying the power addition in the angular direction. When the perturbation is small, flow equations and boundary conditions split into zeroth order and first order sets. The former is numerically integrated outward, thus checking results already known. The infinite temperature singularity at the origin is properly identified. The linear first order problem is decomposed in Fourier series of the angular variable. For harmonics one to five numerical results are obtained for the velocity components, density and pressure profiles; the size of the perturbed spark is calculated. Maps are presented of the stream lines and constant density lines.
Dissert. Abstr.

N73-32172 Illinois Univ., Urbana.
TURBULENT GAS-SOLID ELECTROHYDRODYNAMIC FLOW INTO A CHANNEL Ph.D. Thesis
John Martin Hughes 1973 232 p
Avail: Univ. Microfilms Order No. 73-17568

The behaviour of 14 micron magnesium oxide particles suspended in turbulent air flow was investigated for three cases, namely, no applied electric field, an applied electrostatic field, and an applied electrodynamic field resulting from a corona discharge. Experiments with various carrier gas velocities, channel widths, mass flow ratios of solids to air, particle change mass ratios, electrode to channel entrance spacings, and electrode potentials were conducted. The experimental system consisted of a 12 in. by 12 in. cross section variable speed wind tunnel in which a single 0.010 in. diameter electrode was suspended vertically in the center. Two parallel flat stainless steel plates with sharp leading edges were symmetrically spaced about the centerline immediately downstream from the electrode in a geometric arrangement similar to that of a two-stage electrostatic precipitator element. The distributions of mass flow were measured for the solid phase with an isokinetic sampling system. Other measurements included were the carrier gas velocity distributions, corona current, plate current, electrode potential, and D. C. corona field potential. Dissert. Abstr.

N73-32173 New Mexico Univ., Albuquerque.
A NUMERICAL AND EXPERIMENTAL STUDY OF THE MIXING REGION IN A FLUIDIC BEAM-DEFLECTION AMPLIFIER Ph.D. Thesis
Fred Neil Mortensen, II 1972 191 p
Avail: Univ. Microfilms Order No. 73-16577

The vorticity transport equation and the stream function relationships for a two dimensional, laminar, incompressible fluid were solved numerically with the no-slip and no-penetration condition at surface boundaries for the geometry of the mixing region of a typical beam deflection amplifier. Information for both steady state and transient cases was presented. A method for solving the flow field in the neighborhood of a trailing edge was developed. In addition, a number of exit conditions were studied to find one which realistically modeled the flow field.
Dissert. Abstr.

N73-32174 Rhode Island Univ., Kingston.
INTERNAL SEPARATED FLOWS EXPANSIONS, NOZZLES, AND ORIFICES Ph.D. Thesis
Raymond Girard Teyssandier 1973 146 p
Avail: Univ. Microfilms Order No. 73-16542

An integral method has been developed to solve a class of internal separated flow problems in pipes where the core velocity is of constant magnitude and the streamlines are parallel at entry. This method has been applied to sudden expansions and ASME flow nozzles for the range 0.25 smaller than or equal to beta smaller than or equal to 0.7. Using a simplified analysis for the flow immediately downstream of an orifice, the above method has been extended to solve for the discharge coefficient as a function of axial position beyond the vena contracta.
Dissert. Abstr.

N73-32175 Iowa State Univ. of Science and Technology, Ames.
OSCILLATING FLOW IN A CONSTRICTED TUBE Ph.D. Thesis
Lawrence Arnette Davis, Jr. 1973 148 p
Avail: Univ. Microfilms Order No. 73-16952

The results are presented of a theoretical and experimental study of the flow characteristics associated with laminar oscillating flow in a horizontal rigid straight tube which contains a mild axisymmetric constriction. The flow characteristics of interest were: pressure drop across the constriction, velocity profiles, wall shearing stress and related separation phenomena. The mathemati-

cal model of the physical problem was developed by assuming that the fluid was Newtonian (incompressible) and the constriction mild. Other assumptions of a physical and analytical nature were made to obtain a tractable set of equations. An approximate solution of the resulting system of equations, in which convective inertia terms were retained, was obtained from an extension of the Pohlhausen method for analyzing boundary layer flow. The theoretical solution was compared with related studies and experimental results. Computer programs for the evaluation of pressure drop and wall shearing stress along the constriction and for plotting of velocity profiles are included. Dissert. Abstr.

N73-32176 Purdue Univ., Lafayette, Ind.
A PROPOSED TECHNIQUE FOR DISCRETIZATION OF BOUNDARY CONDITIONS IN TIME-DEPENDENT, VISCOUS, COMPRESSIBLE FLOWS Ph.D. Thesis
Palmer Bang-Ming Chiu 1972 183 p
Avail: Univ. Microfilms Order No. 73-15785

A procedure is developed to implement numerically the boundary conditions of a time-dependent viscous compressible flow. Based upon the significance of subcharacteristics and a heuristic argument of a small perturbation of the Navier-Stokes system, a viscous analog of the theory of characteristics is developed by casting the Navier-Stokes equations in the direction of the inviscid characteristics. This viscous analog permits the domain of dependence of the Navier-Stokes system to be discussed. Futhermore, utilizing this analog and by differentiating the physical boundary conditions on the boundaries, sets of partial differential equations applicable at various boundaries in the viscous case are formulated. These partial differential equations are then discretized by application of finite-difference approximations in numerical calculation of laminar flows. Dissert. Abstr.

N73-32177 Johns Hopkins Univ., Baltimore, Md.
STATISTICAL MODEL OF TURBULENCE Ph.D. Thesis
Rena Liu Lee 1973 146 p
Avail: Univ. Microfilms Order No. 73-16651

A basic set of elementary solutions of the linearized Navier-Stokes equations was derived and it may serve as building blocks toward a theoretical model of turbulence for both homogeneous, and possibly isotropic, as well as shear flow turbulence. The basic structure of the large scale motion is constructed from the so-called D vortex and Q vortex solutions of linearized Navier-Stokes equations. In describing the basic structure, statistical representation was employed because of experimental evidence of the random occurrence of the eddies in the turbulent flow field. It has been shown theoretically that by using the proposed model the large eddies move away from the solid wall and they become elongated along the mean flow direction. The feature of the turbulent boundary layer can be explained in this fashion. Finally, the statistical approach was used to build a very crude model of the axisymmetric jet. Random release of D vortices with a Poisson distribution in time resulted in the necessity of accounting between these calculated results and the results shown in the existing documents gave new insight to the problem. Dissert. Abstr.

N73-32178 Johns Hopkins Univ., Baltimore, Md.
THE TURBULENT INTERFACE Ph.D. Thesis
Spiro Theodore Paizis 1973 169 p
Avail: Univ. Microfilms Order No. 73-16659

The sharp interface which exists in unbounded turbulent shear flows was studied using a linear array of twenty hot-wire probes. The probe arrangement was such that the location of the interface could be monitored instantaneously. The particular flow examined was a two-dimensional turbulent wall jet. It was found that the interface is a highly contorted surface which exhibits a significant amount of folding. Quantitative methods for characterizing this behaviour are presented, together with pertinent measurements. In addition, measurements of the mean surface area of the interface, and space-time correlations of the width of the turbulence were obtained. The latter were used to find characteristic scales and convection velocities of the interface. An expression for the rate of entrainment of nonturbulent fluid is reported and was used to estimate entrainment rates in self-preserving flows. Finally, a dynamical theory which treats the interface as a surface that is singular with respect to vorticity is proposed.
Dissert. Abstr.

N73-32179 Illinois Univ., Urbana.
ANALYSIS OF TRANSIENT WAVE MOTION IN LIQUID FILLED CYLINDERS Ph.D. Thesis
Charles Frearson Holt 1973 105 p
Avail: Univ. Microfilms Order No. 73-17562

An analytical model is presented representing the unsteady compressible flow within a circular cylinder. Special initial and boundary conditions make the problem applicable to positive displacement fluid pumps operating at high pressure and high rotational speed. The governing equations are solved on an IBM 360/75 computer via the method of characteristics. The analysis provide information on the transient pressure and velocity fluctuation within the cylinder which is terminated at one end by a moving piston and at the other end by an orifice having a time varying diameter. The transient flow through the orifice plays a dominant role in characterizing the flow conditions within the cylinder and is analyzed via a numerical integration of the unsteady Bernoulli equation. Various parameters and flow conditions are investigated as to their effect on the transient fluctuations within the cylinder. Dissert. Abstr.

N73-32180 Purdue Univ., Lafayette, Ind.
HIGHER-ORDER EFFECTS ASSOCIATED WITH STEADY STREAMING ABOUT A VIBRATING SPHERE Ph.D. Thesis
Thomas Cobb Booth 1972 245 p
Avail: Univ. Microfilms Order No. 73-15775

The flow about a sphere undergoing rectilinear, sinusoidal oscillations in a viscous, incompressible fluid is considered. This type of motion leads to a velocity field whose time average is non-zero. The steady flows are applicable to pollution problems. The periodic flow field is characterized by two non-dimensional parameters. The first is the ratio of the diffusion distance per oscillation cycle to the sphere radius. The second is the ratio of the sphere oscillation amplitude to the periodic diffusion distance. The case of interest is when both of these parameters are small such that there is a boundary layer and ordered such that the boundary-layer thickness is much larger than the oscillation amplitude. The method of matched-asymptotic expansions is used to calculate the velocity field using a uniformly-valid series. The gauge sequence chosen for the series is in powers of the two small parameters. Dissert. Abstr.

N73-32181 Florida Univ., Gainesville.
STOCHASTIC MODELING OF TURBULENT HEAT AND MASS TRANSPORT IN ANISOTROPIC SHEAR FLOW Ph.D. Thesis
Ralf Gielow 1972 294 p
Avail: Univ. Microfilms Order No. 73-15496

Stochastic models for the motion of a fluid particle and for turbulent heat or mass transport were developed for a fully established nonhomogeneous turbulent shear flow field. These general models were applied to the case of pressure-driven flow between parallel plates. Results corresponding to the homogeneous and nonshear situation were also obtained. The stochastic field constituting the turbulent flow was decomposed into its constitutive parts: the deterministic mean values and the statistical fluctuations around the mean values. By averaging the Lagrangian form of the equation of motion, certain spatial derivatives of the Reynolds stresses can be interpreted as components of a mean Lagrangian acceleration. The integration of the mean Lagrangian acceleration yields the deterministic velocity and position loci. A simple theoretical relationship between the components of the mean Lagrangian acceleration was derived by imposing the condition that these deterministic loci are closed curves in a coordinate system convected by the local mean velocity of the nonhomogeneous flow field. Semi-empirical expressions for the local Reynolds stress components were proposed and fitted to available data. The deterministic loci were computed from these expressions. Dissert. Abstr.

N73-32182 Rutgers Univ., University Park, N.J.
TURBULENT GAS-SOLIDS FLOW MEASUREMENTS UTILIZING A LASER DOPPLER VELOCIMETER Ph.D. Thesis
Curtis Raymond Carlson 1973 243 p
Avail: Univ. Microfilms Order No. 73-15663

A laser Doppler velocimeter was developed to measure turbulent particle velocities in gas-solids flow. An analytical model

of the Doppler process was developed and an experimental facility constructed. The large particle bias, which has prevented previous applications, was eliminated and detailed measurements were performed for two distinct particle sizes. A comprehensive discussion of the Doppler technique, as it applies to this application, was formulated. The entrance beams were described by Gaussian intensity distributions with propagation characteristics given by scaler diffraction theory. Spherical particles were assumed for the particulate phase, and the Mie light scattering theory was used to calculate the intensity of the received signal. The spatial and temporal resolution of the system was determined by using the fringe model of the Doppler process. Using these results it was possible to design the receiving optics to act as a selective optical filter to discriminate against particles of a given size. By properly matching the bandpass characteristics of this filter with the particle distribution under study, the received signal was made almost independent of the particle size. Other results relating to the optical geometry, resolution, and general applicability of the technique are given. Dissert. Abstr.

N73-32183 Kansas State Univ., Manhattan.
A STUDY OF TIME DEPENDENT FLOWS IN CYLINDERS OF ARBITRARY CROSS SECTION CONTAINING AN INCOMPRESSIBLE, VISCOUS NEWTONIAN FLUID Ph.D. Thesis
Peter Bii-Der Wang 1973 150 p
Avail: Univ. Microfilms Order No. 73-16999

The flow induced by the harmonic oscillation of rods with different geometric cross-section shapes both theoretically and experimentally was investigated. Cartesian tensors were used to derive the governing differential equation which was found to be a linear partial differential equation. Consequently, the principle of superposition was applicable. The velocity caused by a line of infinite length cated on by a unit force was introduced as a fundamental solution. One advantage of this simple physical ideal is that it allows the solution of the problem for a source having an arbitrary-cross-section to be written directly in terms of this fundamental solution. That is, integration of the fundamental solution with respect to the space variables yields the solution for a time independent source of arbitrary-cross-section. Integration of these solutions for constant forces weighted with respect to time yields solutions for time-variable sources.
Dissert. Abstr.

N73-32184 California Inst. of Tech., Pasadena.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A TURBULENT MIXING LAYER OF DIFFERENT GASES IN A PRESSURE GRADIENT Ph.D. Thesis
Manuel Rebollo Rebollo 1973 141 p
Avail: Univ. Microfilms Order No. 73-14314

An analytical and experimental study has been made of the turbulent mixing layer in a pressure gradient. Theory predicts the possible existence of equilibrium flows, and this was confirmed experimentally for turbulent shear layers between streams of helium and nitrogen. The experimental investigation was conducted in a facility designed to produce turbulent flows at pressures up to 10 atmospheres. The adjustable walls of the test section of the apparatus were modified in order to set the pressure gradient. Shadowgraphs of the mixing zone for alpha = 0 and alpha = 0.18, at different Reynolds numbers, revealed a large scale structure noticeably different for each alpha. The similarity properties of the shear layer were established from mean profiles of total head and density. In addition, the rms density fluctuations were found to be selfpreserving. From the mean profiles, the spreading rate, turbulent mass diffusion, Reynolds stress and Schmidt number distributions were calculated from the equations of motion. Dissert. Abstr.

N73-32185 Johns Hopkins Univ., Baltimore, Md.
ULTRASOUND AND LIGHT SCATTERING IN A DIFFUSING AND CHEMICAL REACTING BINARY MIXTURE OF FLUIDS Ph.D. Thesis
Ming-Nan Kuang 1973 89 p
Avail: Univ. Microfilms Order No. 73-16647

The propagation of forced ultrasonic waves in a classical binary mixture of viscous, thermally conducting, diffusive fluids with chemical reaction was studied using the hydrodynamical approach. The constitutive evaluations for the fluid mixture were developed with modern non-equilibrium thermodynamic theory and using the entropy inequality formulated by Muller. There resulted linear relations comparable to classical forms developed from irreversible thermodynamics and kinetic theory. A generalized Fick's Law was obtained which included a diffusive inertial term. The linearized balance equations were solved for the absorption and dispersion of ultrasonic waves. In addition, the problem of Brillouin light scattering in the binary mixture of fluids was studied. Results were obtained for the case of no reaction but diffusion and the case of reaction without diffusion. Dissert. Abstr.

N73-32186# Tokyo Univ. (Japan). Inst. of Industrial Science.
DROPWISE CONDENSATION Report of the Institute of Industrial Science, Vol. 23, No. 2
Ichiro Tanaswa, Futio Tachibana, and Junichi Ochiai Aug. 1973 40 p refs
Avail: NTIS HC $4.00

A digital computer method for simulating the entire process of dropwise condensation is developed. Droplets are assumed to originate on randomly chosen nucleation sites, where they grow obeying the previously established law of growth, coalesce with neighboring droplets and finally roll downward due to the action of external forces such as gravity and/or shear force by vapor flow. Careful considerations are given so that each of these processes may describe the actual phonomenon as precisely as possible. Author

N73-32187*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
HIGH ENTHALPY HYPERSONIC BOUNDARY LAYER FLOW
Gilbert Yanow 6 Nov. 1972 162 p refs
(Grant NGR-39-009-129)
(NASA-CR-135479; PSU-IRL-SCI-395) Avail: NTIS HC $10.25 CSCL 20D

A theoretical and experimental study of an ionizing laminar boundary layer formed by a very high enthalpy flow (in excess of 12 eV per atom or 7000 cal/gm) with allowance for the presence of helium driver gas is described. The theoretical investigation has shown that the use of variable transport properties and their respective derivatives is very important in the solution of equilibrium boundary layer equations of high enthalpy flow. The effect of low level helium contamination on the surface heat transfer rate is minimal. The variation of ionization is much smaller in a chemically frozen boundary layer solution than in an equilibrium boundary layer calculation and consequently, the variation of the transport properties in the case of the former was not essential in the integration. The experiments have been conducted in a free piston shock tunnel, and a detailed study of its nozzle operation, including the effects of low levels of helium driver gas contamination has been made. Neither the extreme solutions of an equilibrium nor of a frozen boundary layer will adequately predict surface heat transfer rate in very high enthalpy flows. Author

N73-32188*# Kanner (Leo) Associates, Redwood City, Calif.
THE FORMATION OF VORTICES IN A FREE BOUNDARY LAYER
H. Schade and A. Michalke Washington NASA Sep. 1973 23 p refs Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 10, no. 4/5, 1962 p 147-154 and DVL report DVL-216
(Contract NASw-2481)
(NASA-TT-F-15133; DVL-216) Avail: NTIS HC $3.25 CSCL 20D

The phenomenon of ring-vortex formation for the case of low viscosity is discussed. The following explanation for the mechanism of formation is proposed: a wall boundary layer caused by friction is formed in the nozzle which produces the stream, with a free boundary layer forming in its wake; both can be calculated from boundary layer theory. The boundary layer is unstable with respect to induction for a certain range of frequencies and wavelengths, which can be calculated from frictionless stability theory. All unstable wavelengths can be artificially excited; in the absence of artificial excitation, the occurring disturbance will be that of greatest possible instability. As soon as the dominant wavelength has established itself, the boundary layer rolls out

because of the disturbed induction equilibrium, while the frequency and wavelength remain unchanged. Author

N73-32189*# Iowa State Univ. of Science and Technology, Ames.
PREDICTION OF OVERALL AND BLADE-ELEMENT PERFORMANCE FOR AXIAL-FLOW PUMP CONFIGURATIONS
George K. Serovy, Patrick Kavanagh, Theodore H. Okiishi, and Max J. Miller Washington NASA Aug. 1973 248 p refs (Grant NGL-16-002-005)
(NASA-CR-2301; ISU-ERI-AMES-72322) Avail: NTIS HC $5.75 CSCL 20D

A method and a digital computer program for prediction of the distribtions of fluid velocity and properties in axial flow pump configurations are described and evaluated. The method uses the blade-element flow model and an iterative numerical solution of the radial equilbrium and continuity conditions. Correlated experimental results are used to generate alternative methods for estimating blade-element turning and loss characteristics. Detailed descriptions of the computer program are included, with example input and typical computed results. Author

N73-32190*# Pennsylvania State Univ., University Park.
INVESTIGATIONS OF THREE DIMENSIONAL FLOW CHARACTERISTICS IN A THREE BLADED ROCKET PUMP INDUCER
A. Poncet and B. Lakshminarayana Washington NASA Sep. 1973 133 p refs
(Grant NGL-39-009-007)
(NASA-CR-2290; PSU-AERSP-70-1) Avail: NTIS HC $4.50 CSCL 20D

Because of the long and narrow passages between the blades of a rocket pump inducer, major effects from turbulence and viscosity make the flow through such a device truly three-dimensional and therefore difficult to measure or predict. To investigate the flow characteristics, conventional and three-dimensional hot-wire probe measurements were conducted in a model inducer 3 ft in diameter. Blade-to-blade variation of the three components of velocity at the exit and the corresponding turbulence intensities were obtained by means of hotwire probes aligned in the three coordinate directions. Analysis of the three-dimensional inviscid flow field led to qualitative prediction of the flow characteristics. Extensive measurements and theoretical analyses of the flow field showed that blade blockage, viscosity, and blade boundary layer interactions are the dominant influences on flow in this type of turbomachinery. Author

N73-32191*# New York Univ., N.Y. School of Engineering and Science.
ANALYSIS OF AN ENTRAINMENT MODEL OF THE JET IN A CROSSFLOW
H. S. Chang and J. E. Werner Nov. 1972 89 p refs
(Grant NGR-33-016-141)
(NASA-CR-132324; NYU-AA-72-27) Avail: NTIS HC $6.50 CSCL 20D

A theoretical model has been proposed for the problem of a round jet in an incompressible cross-flow. The method of matched asymptotic expansions has been applied to this problem. For the solution to the flow problem in the inner region, the re-entrant wake flow model was used with the re-entrant flow representing the fluid entrained by the jet. Higher order corrections are obtained in terms of this basic solution. The perturbation terms in the outer region was found to be a line distribution of doublets and sources. The line distribution of sources represents the combined effect of the entrainment and the displacement. Author

N73-32192# Pratt and Whitney Aircraft, East Hartford, Conn.
BOUNDARY CONDITIONS AND UNIQUENESS IN INTERNAL GAS DYNAMIC FLOWS
Anthony A. Ganz and Raymond A. Serra 17 May 1973 37 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Mar. 1974
Avail: NTIS HC $4.00

A procedure is developed for the establishment of boundary conditions which guarantee unique solutions for problems involving multidimensional, internal gas dynamic flows. This work is based on the general theory of linear symmetric positive systems for application in the numerical computation of gas dynamic flows, particularly when the difference scheme utilized is of higher order than the equation system. In particular, boundary conditions are developed for subsonic, transonic, and supersonic internal flows in steady state and transient formulations. It is shown explicitly how the downstream boundary condition can be set for the subsonic case, disappears in the transonic case, and reappears as an inflow boundary condition for the supersonic case. It is emphasized that the mass flow is determined by the downstream boundary condition, and that it is not correct to totally specify the inflow profile in subsonic flows. The utility of the method in obtaining boundary conditions for nonlinear problems found in more general engineering applications is also discussed. Author

N73-32193# Kyushu Univ., Fukuoka (Japan).
SMALL DISTURBANCE THEORY OF ROTATING SUBSONIC AND TRANSONIC CASCADES
M. Namba 23 Jun. 1972 45 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972; sponsored by Army and AF European Res. Offices, London, by Roy. Soc. of London, and by Cambridge Univ.
Avail: NTIS HC $4.25

A linearized inviscid, isentropic, three-dimensional flow theory for a rotating thin blade row in a cylindrical duct with subsonic axial flow velocity and subsonic or supersonic relative tip velocity was developed on the basis of pressure dipole representations. A new method of approximation to Fourier Bessel double series was employed to evaluate the singularities. The theory was successfully applied to the inverse problem. Some numerical examples are provided. The validity of the blade element concept is discussed. The essential flow features for transonic compressors are demonstrated. Author

N73-32194# Aeronautical Research Labs., Melbourne (Australia).
VISCOUS INTERACTION IN INTEGRATED SUPERSONIC INTAKES
Murdoch Culley 23 Jun. 1972 33 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1973
Avail: NTIS HC $3.75

An experimental investigation has been conducted into the nature of the flow interference which occurs between a supersonic intake and an airframe in an integrated design of aircraft. It has been shown that an intake pressure field is of ample strength to cause three dimensional separation of a boundary-layer within its influence. The most energy deficient portion of the separated boundary layer is diverted by the separation, to be spilled into the airstream as vortices. A shock wave is generated by the three dimensional separation, and through this the boundary layer is able to influence the intake flow. There is good evidence that the separation shock is not steady. Author

N73-32195# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
INVESTIGATIONS ON INCIPIENT BOUNDARY LAYER SEPARATION ON AXISYMMETRIC COMPRESSION SURFACES
Wolfgang Wyborny and Hans-Peter Kabelitz 1972 36 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1973
Avail: NTIS HC $4.00

Experimental investigations on incipient boundary layer separation on axisymmetric compression surfaces were performed in a gun tunnel at free stream Mach 8.8 and free stream Mach 13.5. The models consisted of a conical forebody and a cone frustrum connected by a smooth curved junction section. Different types of geometric similar pressure distributions were realized by varying the junction section geometry. Incipient separation data obtained from Schlieren observations were not correlated by parameters which are used to predict sharp corner flow separation. Correlation parameters are derived and applied to incipient separation data in such cases where the junction section starts with an infinite large radius of longitudinal wall curvature. Author

N73-32196# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STUDY OF SHOCK WAVES PATTERNS IN AN AXIAL SUPERSONIC COMPRESSOR

Jacques Paulon 1972 8 p. refs In FRENCH; ENGLISH summary Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1973

Avail: NTIS HC $3.00

Performance and operation stability of a transonic or supersonic compressor are conditioned by the intensity of the shock waves and their position in the blade channels. An experimental facility which, in a small height annular channel, simulates a rotating cascade at supersonic speed, provides optimum conditions to study the shock wave pattern and stability. This facility, using Freon 114 as working gas, includes a window for visualization through which one records instantaneous schlieren shock wave configurations. Outer wall pressure taps give mean pressure repartitions in blade channels and check indications taken from schlieren pictures. Thus, it is possible to show that in function of back pressure, several flow patterns are obtained which extend from entirely supersonic operation in blade channels to rotating stall operation. Author

N73-32197*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MONTE CARLO ANALYSIS OF RAREFIED-GAS DIFFUSION INCLUDING VARIANCE REDUCTION USING THE THEORY OF MARKOV RANDOM WALKS

Morris Perlmutter Washington Oct. 1973 41 p refs

(NASA-TN-D-7405; E-6794) Avail: NTIS HC $3.00 CSCL 20D

Molecular diffusion through a rarefied gas is analyzed by using the theory of Markov random walks. The Markov walk is simulated on the computer by using random numbers to find the new states from the appropriate transition probabilities. As the sample molecule during its random walk passes a scoring position, which is a location at which the macroscopic diffusing flow variables such as molecular flux and molecular density are desired, an appropriate payoff is scored. The payoff is a function of the sample molecule velocity. For example, in obtaining the molecular flux across a scoring position, the random walk payoff is the net number of times the scoring position has been crossed in the positive direction. Similarly, when the molecular density is required, the payoff is the sum of the inverse velocity of the sample molecule passing the scoring position. The macroscopic diffusing flow variables are then found from the expected payoff of the random walks. Author

N73-32198# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.

NUMERICAL METHOD OF CHARACTERISTICS TAKING INTO CONSIDERATION DISSIPATIVE TERMS

Werner Koch 29 Mar. 1972 35 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-23) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 10,20 DM

A numerical method of characteristics is developed for unsteady processes with dissipation. With the governing equations written in terms of the subcharacteristic coordinates of the dissipationless system, the dissipative processes are taken into account by additional inhomogeneous terms. For weak disturbances these dissipative terms are linearized and the resulting equations are conceptually equilivalent to Burgers equation as is demonstrated by examples of the piston problem and the reflection of a weak shock from a wall. The advantage of the method lies in a clear identification of the region of influence, which is important for numerical stability, although the complicated form of the equations in comparison with straight-forward difference methods diminishes that advantage in practical applications. Author (ESRO)

N73-32199# Naval Ship Research and Development Center, Bethesda, Md.

EVALUATION OF LIFTING-SURFACE PROGRAMS FOR COMPUTING THE PRESSURE DISTRIBUTION ON PLANER FOILS IN STEADY MOTION

Thomas J. Langan and Henry T. Wang May 1973 73 p refs

(AD-763669; NSRDC-4021) Avail: NTIS CSCL 13/10

The pressure differences, forces, and moments on the same two wings in steady subsonic flow were computed by 15 different programs. These results were compared with each other and with available experimental data. Nine of the programs gave predictions that were generally in close agreement with each other and with the experimental results, four showed moderate differences, and the remaining two showed significant differences. Author (GRA)

N73-32200# Wisconsin Univ., Madison. Mathematics Research Center.

VARIABLE-PROPERTY EFFECTS ON FORCED CONVECTION IN LAMINAR BOUNDARY LAYERS. 1: ASYMPTOTIC SOLUTIONS FOR RIGID INTERFACES

Warren E. Stewart, Roderick Kilgour, and Ke-Tien Liu Jun. 1973 46 p refs

(Contract DA-ARO(D)-31-124-G462)

(AD-764563; MRC-TSR-1310) Avail: NTIS CSCL 20/4

Perturbation solutions are given for multicomponent, variable-property forced convection along rigid interfaces of arbitrary shape. The development holds asymptotically with increasing Prandtl and Schmidt numbers, and is accurate to second order in the driving forces. Consistent with this order of approximation, the fluid properties are taken as linear functions of temperature or enthalpy, and of the mixture composition. The results include new reference-state rules for short-cut calculations.

Author (GRA)

N73-32201# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

MARCHING VERSUS NONMARCHING FOR A PERIODIC INCOMPRESSIBLE VISCOUS FLOW PROBLEM

L. W. Ehrlich Jul. 1973 34 p refs

(Contract N00017-72-C-4401)

(AD-765323; APL-TG-1218) Avail: NTIS CSCL 20/4

A fourth-order, time-dependent, partial-differential flow equation is solved by a coupled pair of finite-difference equations. Three marching techniques are compared with each other and with a nonmarching technique. Author (GRA)

N73-32202# Naval Ship Research and Development Center, Bethesda, Md.

APPLICATION OF THE STANTON TUBE TO THE MEASUREMENT OF WALL SHEAR STRESS ON A FLAT PLATE WITH POLYMER EJECTION Final Report

William G. Souders May 1973 34 p refs

(AD-764896; NSRDC-3849) Avail: NTIS CSCL 20/4

An experimental investigation was made to determine the effects on drag of injecting aqueous solutions of polyethylene oxide into the turbulent boundary layer of a flat plate. The local mean wall shear stress was measured with a Stanton tube located in the laminar sublayer. Diffusion of the polymer in the boundary layer was also investigated by analysis of fluid samples withdrawn from the flat plate surface. In addition, a related but independent experimental turbulent pipe flow study was undertaken to determine any changes in Stanton tube sensitivity caused by the viscoelasticity of the polymer solutions. (Modified author abstract) GRA

N73-32203# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

NUMERICAL SOLUTION OF CORNER FLOW PROBLEM USING AN ALTERNATING DIRECTION IMPLICIT METHOD Final Report

K. N. Ghia and R. T. Davis Jul. 1973 96 p refs

(Contract F33615-72-C-1128; AF Proj. 7064)

(AD-765209; ARL-73-0119) Avail: NTIS CSCL 20/4

The axial corner flow problem has been analysed for the general compressible case. The equations describing this flow in terms of similarity variables are nonlinear elliptic partial differential equations. For the purpose of developing an efficient method for solving these compressible flow equations, and ADI (alternating direction implicit) method is formulated for the corresponding limiting case of incompressible corner flow. An optimization study of the method has been carried out in order to maximize the solution convergence rate while maintaining its stability and accuracy. The results obtained by the present method compare well with the available results due to the Gauss Seidel explicit method. The influence of symmetry boundary on

the solution convergence rate has been studied and the appropriate manner of specifying this boundary condition for numerical computation has been established. The boundary condition on the vorticity function at the wall has been analyzed, and the advantages of the implicit treatment of this boundary condition over explicit treatment are presented. The effect of total second order accuracy of the ADI method in light of numerical stability and accuracy of the solution of the finite difference equations is indicated. The ADI method is seen to possess certain advantages over the Gauss Seidel explicit method. Author (GRA)

N73-32204# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
EFFECT OF SHOCK IMPINGEMENT ON HEAT TRANSFER Interim Scientific Report, 1 May 1972 - 30 Apr. 1973
Jean J. Ginoux and Richard D. Matthews May 1973 74 p refs
(Grant AF-AFOSR-2147-71; AF Proj. 9781)
(AD-764983; VKI-TN-87) Avail: NTIS CSCL 20/4

Static pressure and heat transfer rate distributions were measured in the reattachment region of free shear layers. In the first part, a cone/cavity model and the effects of gas injection were studied. Results are presented for both laminar and turbulent flows. In the second part, a flow model was investigated which is analogous with an Edney type 3 shock wave interaction, found when the bow shock of a blunt hypersonic body is intersected by an extraneous shock. Author (GRA)

N73-32205# Naval Ship Research and Development Center, Bethesda, Md.
PROGRESS IN FRICTION DRAG REDUCTION. SUMMER 1971 TO SUMMER 1972
Paul S. Granville Jan. 1973 51 p refs
(AD-757012; NSRDC-3994) Avail: NTIS CSCL 20/4

A summary of progress in the achievement of frictional drag reduction is presented in terms of highlights, laboratory activities, and bibliographic entries from the summer of 1971 to the summer of 1972. Author

N73-32206# Goodyear Aerospace Corp., Akron, Ohio.
EXPANDABLE FLOATING BASES PROGRAM: MODEL TEST AND ANALYSIS Final Report
Glenn W. Quaint 30 Jan. 1973 403 p refs
(Contract N00014-72-C-0477; ARPA Order 1645)
(AD-756048; GER-15665) Avail: NTIS CSCL 13/10

The report covers research directed specifically toward examining and comparing the responses of similarly configured expandable and rigid bodies subject to wave action, investigation of hydrodynamic problems associated with closely spaced multiple floats in an array, and an assessment of cost of expandable structures in relation to certain design requirements for a floating base. (Author modified abstract) GRA

N73-32207# URS Research Co., San Mateo, Calif.
GENERATION OF A VORTEX RING BY THE SUDDEN COMBUSTION OF GAS
Anthony R. Kriebel Jul. 1973 27 p refs
(Contract N00014-72-C-0225)
(AD-764613; URS-7207-3) Avail: NTIS CSCL 20/4

Tests were run to investigate the feasibility of generating air vortex rings by the rapid combustion and expansion of propane-air mixtures near the bottom of a short cylinder to drive the air out of the cylinder. A total of 52 such tests were run with various amounts of propane. The gas mixtures ignited for 48 of these tests. Only slow speed vortex rings were generated, however, and these occurred only when the volume of burned gas was much greater than required to fill the cylinder. When less gas was burned, the air which was expelled from the cup did not form a vortex ring and propagate away from the cup. The reason for this, apparently is that the mixing of the propane and air was so poor that the combustion and expansion was too slow to impart enough kinetic energy to the expelled gases. Author (GRA)

N73-32208# Bell Aerospace Co., New Orleans, La.
WATER-AUGMENTED VEHICLE (WAVE) STUDY - PHASE 1 Final Report, 5 Jun. - 31 Dec. 1972
Charles D. Hope-Gill, George Rudinger, Stephen W. Zelazny, and John H. Morgenthaler 1 Mar. 1973 134 p refs
(Contract N00014-72-C-0306; NR Proj. 259-097)
(AD-765332) Avail: NTIS CSCL 13/10

The report deals with the analytical investigation of the thrust augmentation, lift forces and mixing properties of a two-phase flow propulsion/lift system which has application to Air Cushion Vehicles (ACV) and Surface Effect Ships (SES). The results of Water-Augmented Vehicles (WAVE) computer program investigations show that significant thrust augmentation can be obtained by the injection of spray inherently produced through the interaction of ACV's and SES's with water surfaces. In addition propulsive efficiencies of 60% can be obtained with relatively quiet operation. The flow model I analysis conducted was based on a modified, one-dimensional duct flow and considered the transverse injection of spray and cushion air into the propulsion duct. Flow pressure losses, leakage of propulsion air from the propulsion duct, droplet breakup and the penetration of spray droplets into the propulsion duct where taken into account. (Modified author abstract) GRA

N73-32209# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF REAL PROPERTIES OF AIR ON PARAMETERS OF FLOW NEAR AN ELLIPTIC CONE. AERODYNAMIC CHARACTERISTICS OF ELLIPTIC CONES AT LARGE ANGLES OF ATTACK
A. P. Bazzhin, O. N. Trusova, and I. F. Chelysheva 27 Jul. 1973 16 p refs Transl. into ENGLISH from Uch. Zap. Tsagi, Tsent. Aerogidrodinam. Inst. (USSR), v. 1, no. 2, 1970 p 46-52
(AD-764945; FTD-HT-23-708-73) Avail: NTIS CSCL 20/4

The calculation results of a flow around a family of elliptic cones by a flow of ideal gas at large angles of attack were presented in previous reports. Subsequently, several variants of flow were calculated taking into account the real properties of air, which are in a state of thermodynamic equilibrium. These calculation results permit one to evaluate the effect of real gas properties, which proves to be insignificant for the variants of flow. The first part of this report is devoted to this problem. Calculated aerodynamic characteristics of elliptic cones over the angle of attack range from 30 degrees to 50 degrees in the case of an ideal gas are presented in the second part of this report. GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-32210 Department of Energy, Mines and Resources, Ottawa (Ontario). Dept. of Energy, Mines and Resources.
A STUDY OF THE SQ VARIATION FROM THE EIGHT MOST QUIET DAYS OF THE IGY PERIOD Publications of the Earth Physics Branch, Vol. 44, No. 2
J. C. Gupta 1973 31 p refs
Copyright. Avail: Issuing Activity

The daily variation of the geomagnetic field is analyzed for the eight quiet days of the International Geophysical Year (1957-58) when the daily planetary character-figure Cp = 0.0. The amplitudes and phases of the first four harmonics of the average variation on these days in the components X, Y and Z are given for each of the 108 stations analyzed. The average daily variation at each station is also illustrated with daygraphs of X, Y, Z, and with vectograms of X, Y. The resuts are discussed in the light of those obtained by Vestine et al. in their analysis of three very quiet days of the Second International Polar Year (1932-33). The positions of the northern and southern foci in five different longitudinal sectors are also estimated. The study of the daily variation curves presents evidence that the northern current system penetrates the Southern Hemisphere before local noon, and the southern system penetrates the Northern Hemisphere after local noon. Author

N73-32211 Wisconsin Univ., Madison.
ON THE DYNAMICS OF WIND DRIVEN LAKE CURRENTS Ph.D. Thesis
John Richard Bennett 1972 93 p
Avail: Univ. Microfilms Order No. 73-10702

Two time-dependent, vertical cross-section models are analyzed and applied to wind-driven currents in Lake Ontario. The models are: (1) a linear frictionless, two-level model, and (2) a numerical model which includes both friction and nonlinear terms. They predict current and temperature under the assumption that all variables except pressure are independent of the longshore coordinate. The longshore pressure gradient is computed from the condition that the volume transport normal to the cross-section is zero. First, the quasi-static response of the linear frictionless model is studied to isolate the effects of topography and stratification on the structure of the coastal currents. It predicts that the vertically averaged longshore current is independent of both rotation and stratification, being in the direction of the wind where the water is shallower than average and opposite the wind in the deep water. The strongest currents are confined to a thin region near the shore. The effect of stratification is to increase the width of this coastal jet region and cause the flow to be more confined to the surface layer.
Dissert. Abstr.

N73-32212 Cornell Univ., Ithaca, N.Y.
THE APPLICATION OF BARKER CODED PULSES IN INCOHERENTS SCATTER OBSERVATIONS OF THE IONOSPHERE Ph.D. Thesis
George A. Ioannidis 1973 199 p
Avail: Univ. Microfilms Order No. 73-16086

The application of Barker coded pulses in incoherent scatter observations at Arecibo is presented. In all the observations a 7 or 13-bit Barker code was used giving a compression ratio of 7 to 1 or 13 to 1 respectively. A digital decoder was built making it possible to process, in real time, Barker coded pulses with 6 and 4 microsec baud lengths and to achieve a maximum range resolution of 600 meters. In some observations real time correlation from pulse to pulse was used in order to remove stationary clutter. A double pulse scheme was developed to eliminate the need for noise subtraction. The method involved the transmission of two adjacent 7-bit Barker codes and real time correlation of the decoder output for a delay of 7 sampling intervals. A few of the measurements with these techniques are presented here and include observations of (a) the E-region and sporadic E-layers, (b) the D-region ledge near 80 km, and (c) narrow enhanced echoes associated with HF heating of the F-region
Dissert. Abstr.

N73-32213 Case Western Reserve Univ., Cleveland, Ohio.
PROTONOSPHERE-IONOSPHERE COUPLING: NEW BACKSCATTER OBSERVATIONS AT ARECIBO, PUERTO RICO Ph.D. Thesis
Peter You-Sen Hsu 1973 193 p
Avail: Univ. Microfilms Order No. 73-16133

The coupling between the normal F-region ionosphere and the protonosphere is being experimentally investigated using the radar backscatter techniques at Arecibo, Puerto Rico. The experiments yield vertical plasma transport velocity, electron density, ion composition, electron and ion temperature, spanning the complete altitude range from 170 to 1854 km, well into the protonosphere. The results of this research are concerned with two nighttime periods on Feb. 10-11, and Feb. 24-25, 1972. The first night was quiet in contrast to the dynamic nature of the second night when the usual midnight collapse was observed. The post sunset downward velocity is consistent with the cooling of the plasma. The midnight collapse is shown to be caused by a compressional disturbance of protonospheric origin. The exospheric flux is shown to be able to meet the rate of ionization removal via recombination. Thus the maintenance of the the nocturnal ionosphere and the midnight collapse are attributed to events in the protonosphere, suggesting strong coupling between the two regions.
Dissert. Abstr.

N73-32214 Wisconsin Univ., Madison.
A HIGH RESOLUTION STUDY OF THE 6300 A OXYGEN LINE IN THE DAY AIRGLOW Ph.D. Thesis
Frank Edward Barmore 1973 121 p
Avail: Univ. Microfilms Order No. 73-10700

Ground based high resolution spectra of the zenith day sky near 6300 A were obtained with a PEPSIOS spectrometer. When compared with the solar spectrum taken with the same spectrometer, the 6300.3 A emission line of atomic oxygen was clearly present. The filling in of Fraunhofer lines (the Ring effect) in the day sky was also observed.
Dissert. Abstr.

N73-32215*# Geological Survey, Denver, Colo.
REMOTE SENSING GEOPHYSICS FROM SKYLAB Progress Report, Jul. - Aug. 1973
Kenneth Watson, Principal Investigator Aug. 1973 3 p EREP
(NASA Order T-6555-B)
(E73-10998; NASA-CR-133779) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-32216*# Michigan State Univ., East Lansing.
[GROUND TRUTH ACQUISITION] Progress Report, Jul. 1973
Lester V. Manderscheid, Principal Investigator 19 Sep. 1973 1 p EREP
(Contract NAS9-13332)
(E73-11014; NASA-CR-133807) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-32217*# Environmental Research and Technology, Inc., Lexington, Mass.
EVALUATE THE APPLICATION OF ERTS-A DATA FOR DETECTING AND MAPPING SNOW COVER Bimonthly Progress Report, 10 Jul. - 10 Sep. 1973
James C. Barnes, Principal Investigator 27 Sep. 1973 5 p ERTS
(Contract NAS5-21803)
(E73-11038; NASA-CR-133884; ERT-P-407-7; BMPR-5) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. It is concluded from data analysis that the amount of information in ERTS-1 imagery with practical application to snow mapping is substantial. For the Arizona and California test sites, it appears that the extent of the mountain snowpacks can be mapped from ERTS-1 data in more detail than is depicted in aerial survey snow charts. In the Salt-Verde watershed, the agreement between the percentage of the area snow covered as measured from the ERTS-1 data and from aerial survey charts is generally well within 10%. In nearly all of the areas in which greater discrepancies occur, the differences can be explained by changes in snow cover during the interval between the two observations. In the southern Sierra Nevada, the agreement between ERTS-1 data and aerial survey charts is of the order of 5% in all cases, except for the Kaweah Basin on one date. In addition to comparative analysis with aerial snow charts, the ERTS-1 data have also been compared with high altitude aircraft photography. The ERAP data have provided an excellent source of correlative information. The results of the comparative analysis indicate that although small details in the snow line that cannot be detected in the ERTS-1 data can be mapped from higher resolution aircraft data, the boundaries of snow cover can be mapped just as accurately from ERTS-1 data.

N73-32218*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF COLORADO ROCKY MOUNTAIN ENVIRONMENTS USING ADP TECHNIQUES Bimonthly Progress Report, 1 Jul. - 31 Aug. 1973
Roger M. Hoffer, Principal Investigator 31 Aug. 1973 17 p ref ERTS
(Contract NAS5-21880)
(E73-11039; NASA-CR-133885) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-32219*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

INVENTORY OF FOREST AND RANGELAND RESOURCES INCLUDING FOREST STRESS Monthly Progress Report, 16 Aug. - 15 Sep. 1973
Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 15 Sep. 1973 5 p EREP
(NASA Order T-4106-B)
(E73-11040; NASA-CR-133921; MPR-5) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-32220*# Southern Illinois Univ., Carbondale. Dept. of Anthropology.
THE HYDROLOGY OF PREHISTORIC FARMING SYSTEMS IN A CENTRAL ARIZONA ECOTONE Quarterly Report
George J. Gumerman, Principal Investigator 26 Sep. 1973 6 p Prepared in cooperation with Prescott Coll., Ariz. EREP
(Contract NAS9-13342)
(E73-11044; NASA-CR-133929) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-32221*# OVAAC 8 International, Inc., Columbia, Md.
THE APPLICATION OF SATELLITE GENERATED DATA AND MULTISPECTRAL ANALYSIS TO REGIONAL PLANNING AND URBAN DEVELOPMENT
Surendra Anant Raje and Gerald Willoughby, Principal Investigators 1 Oct. 1973 14 p Presented at NASA Symps., Sep. 1972 and Mar. 1973 and at GE Symp., Los Angeles, May 1973 Prepared for General Electric Co., Philadelphia, Pa. ERTS
(Contract NAS5-21797)
(E73-11045; NASA-CR-133930) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-32222*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR LAND USE MANAGEMENT IN MINNESOTA Progress Report, Dec. 1972
George D. Swanlund, Principal Investigator and Raymond E. Zirkle Dec. 1972 2 p ERTS
(Contract NAS5-21742)
(E73-11046; NASA-CR-133944; PR-4) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-32223*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO Progress Report 1 Aug. - 31 Sep. 1973
Daniel H. Knepper, Jr., Principal Investigator and Stephen M. Nicolais 30 Sep. 1973 3 p ERTS
(Contract NAS5-21778)
(E73-11047; NASA-CR-133931) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-32224*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDIES OF IMAGES OF SHORT-LIVED EVENTS USING ERTS DATA Progress Report, 1 Mar. - 30 Aug. 1973
William A. Deutschman, Principal Investigator Oct. 1973 5 p ERTS
(Contract NAS5-21858)
(E73-11048; NASA-CR-133869) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-32225*# Iowa Univ., Iowa City.
UTILIZING ERTS-1 IMAGERY FOR TECTONIC ANALYSIS THROUGH STUDY OF THE BIGHORN MOUNTAINS REGION Progress Report, 16 Mar. - 15 Sep. 1973
Richard A. Hoppin, Principal Investigator 15 Sep. 1973 9 p ERTS
(Contract NAS5-21852)
(E73-11049; NASA-CR-133870) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Comparisons of imagery of three seasons, late summer-fall, winter, and spring indicate that for this region fall imagery is the best for overall geologic analysis. Winter scenes with light to moderate snow cover provide excellent topographic detail owing to snow enhancement, lower sun angle, and clarity of the atmosphere. Spring imagery has considerable reduction of tonal contrast owing to the low reflecting heavy green grass cover which subdues lithologic effects; heavy snow cover in the uplands masks topography. Mapping of geologic formations is impractical in most cases. Separation into tonal units can provide some general clues on structure. A given tonal unit can include parts of several geologic formations and different stratigraphic units can have the same tonal signature. Drainage patterns and anomalies provide the most consistent clues for detecting folds, monoclines, and homoclines. Vegetation only locally reflects lithology and structure. False color infrared 9 x 9 transparencies are the most valuable single imagery. Where these can be supplemented by U-2 color infrared for more detailed work, a tremendous amount of information is available. Adequately field checking such a large area just in one scene is the major logistic problem even in a fairly well known region.

N73-32226*# Alaska Univ., Fairbanks.
SEA, ICE AND SURFACE WATER CIRCULATION, ALASKAN CONTINENTAL SHELF Bimonthly Progress Report
F. F. Wright, G. D. Sharma, and J. J. Burns, Principal Investigators 30 Sep. 1973 5 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 51198 ERTS
(Contract NAS5-21833)
(E73-11050; NASA-CR-133871; BMPR-7) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Salinity and temperature measurements in the Bering Sea indicate that the Yukon River outflow extends as far as 200 km from its mouth. The fresh water flow from the Yukon River flows north and east into Norton Sound. Various levels of suspended sediment concentration in waters have been successfully color coded using a VP-8 color density slicing image analyzer. The 70 mm negative transparencies have provided the best fit for the ground truth observations.

N73-32227*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
ERTS IMAGERY - PROBLEMS AND PROMISES FOR FORESTERS
Robert C. Heller, Principal Investigator 28 Sep. 1973 18 p refs Presented at Intern. Seminar held at Freiburg, 17-21 Sep. 1973 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70251-AG)
(E73-11051; NASA-CR-133872) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-32228*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Jul. - 31 Aug. 1973
Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 20 Sep. 1973 17 p ERTS
(NASA Order S-70251-AG)
(E73-11052; NASA-CR-133933; PR-5) Avail: NTIS HC $3.00 CSCL 02F

The authpr has identified the following significant results. At the Atlanta site (226B) it was found that bulk color composites

for October 15, 1972, and April 13, 1973, can be interpreted together to disclose the location of the perennial Kudzu vine (Pyeraria lobata). Land managers concerned with Kudzu eradication could use ERTS-1 to inventory locations over 200 meters (660 feet) square. Microdensitometer data collected on ERTS-1 Bulk photographic products for the Manitou test site (226C) have shown that the 15-step gray-scale tablets are not of systematic equal values corresponding to 1/14 the maximum radiant energy incident on the MSS sensor. The gray-scale values present a third-order polynomial function rather than a direct linear relationship. Although data collected on step tablets for precision photographic products appear more discrete, the density variation within blocks in almost as great as variations between blocks. These system errors will cause problems when attempting to analyze radiometric variances among vegetation and land use classes.

N73-32229*# Eason Oil Co., Oklahoma City, Okla.
AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION Progress Report, Jun. - Jul. 1973
Robert J. Collins, Principal Investigator 1 Oct. 1973 2 p ERTS
(Contract NAS5-21735)
(E73-11053; NASA-CR-133934) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-32230*# Stanford Research Inst., Menlo Park, Calif. Atmospheric Sciences Lab.
STUDY OF TIME LAPSE PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 6 Mar. - 6 Sep. 1973
Sidney M. Serebreny, Principal Investigator 6 Sep. 1973 30 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21841)
(E73-11054; NASA-CR-133935) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N73-32231*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
STUDY OF THE APPLICATION OF REMOTE SENSING DATA TO LAND USE PLANNING ON THE MISSISSIPPI GULF COAST Progress Report, period ending 10 Oct. 1973
F. M. Ingels, Principal Investigator 5 Oct. 1973 2 p ERTS
(Contract NAS5-21817)
(E73-11055; NASA-CR-133945; PR-5) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-32232*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources (ORSER).
INTERDISCIPLINARY APPLICATION AND INTERPRETATION OF EREP DATA WITHIN THE SUSQUEHANNA RIVER BASIN Quarterly Progress Report, Jun. - Aug. 1973
George J. McMurtry, Principal Investigator Sep. 1973 2 p EREP
(Contract NAS9-13406)
(E73-11056; NASA-CR-133946) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-32233*# National Environmental Satellite Service, Washington, D.C.
A CLOUD PHYSICS INVESTIGATION UTILIZING SKYLAB DATA Quarterly Progress Report, Jul. - Sep. 1973
John Alishouse, Herbert Jacobowitz, and David Wark, Principal Investigators 3 Oct. 1973 5 p refs EREP
(NASA Order T-4715-B)
(E73-11057; NASA-CR-133947; QPR-2) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

N73-32234*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR LAND USE MANAGEMENT IN MINNESOTA Progress Report
George D. Swanlund, Principal Investigator, D. R. Pile, and Raymond E. Zirkle Feb. 1973 6 p ERTS
(Contract NAS5-21742)
(E73-11058; NASA-CR-133948; PR-5) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Progress is being made in the areas of sun angle and atmospheric effects on the data and its interpretation. The effort is aimed at correction using only navigation and calendar data needed for satellite operation and derivations from the MSS data. Water estimation of value to land planners and conservationists has been demonstrated with verification of performance by comparison with a concurrent study involving map planimetry, aerial photos, and field-checking. The satellite will provide seasonal and annual coverage with timely information in a way not now feasible by conventional methods. For example, the reference data were obtained using the most recent files, which date back to 1949, and from most recent photography taken in 1968. The calendar time involved was three to four months, which is a reflection on priority pressure on trained manpower available. ERTS-1 data can help relieve this problem by providing the needed information while freeing trained manpower for more appropriate parts of the effort.

N73-32235*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR LAND USE MANAGEMENT IN MINNESOTA Progress Report
George D. Swanlund, Principal Investigator and D. R. Pile Apr. 1973 15 p refs ERTS
(Contract NAS5-21742)
(E73-11059; NASA-CR-133949; PR-6) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Primary conclusions from the lake acreage study are: (1) The ERTS-1 band 7 density range of 0-5 reliably indicates open water down to 2 acre size. (2) The density range 6-9 identifies swamps. (3) The depth of the water could not be determined. (4) Cloud shadows can be misread as lakes unless the clouds are detected. (5) ERTS-1 data would provide the information for classifying lakes and for monitoring fluctuations in lake area.

N73-32236*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR LAND USE MANAGEMENT IN MINNESOTA Progress Report
George D. Swanlund, Principal Investigator and Raymond E. Zirkle Jun. 1973 2 p ERTS
(Contract NAS5-21742)
(E73-11060; NASA-CR-133951; PR-7) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-32237*# Honeywell, Inc., Minneapolis, Minn. System and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR LAND USE MANAGEMENT IN MINNESOTA Progress Report
George D. Swanlund, Principal Investigator and D. R. Pile Aug. 1973 26 p ERTS
(Contract NAS5-21742)
(E73-11061; NASA-CR-133950; PR-8) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. The Minnesota Iron Range area was selected as one of the land use areas to be evaluated. Six classes were selected: (1) hardwood; (2) conifer; (3) water (including in mines); (4) mines, tailings and wet areas; (5) open area; and (6) urban. Initial classification results show a correct classification of 70.1 to 95.4% for the six classes. This is extremely good. It can be further

improved since there were some incorrect classifications in the ground truth.

N73-32238*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
PRELIMINARY REPORT ON SKYLAB S-193 RADSCAT MEASUREMENTS OF HURRICANE AVA Advance Report of Significant Events
Willard J. Pierson, Jr., Richard K. Moore, Principal Investigators, Vincent J. Cardone, and James D. Young Oct. 1973 18 p refs Prepared in cooperation with City Univ. of New York EREP
(Contract NAS9-13642)
(E73-11062; NASA-CR-135518; CUNY-UIO-23; KU-RSL-254-1) Avail: NTIS HC $3.00 CSCL 04B

The author has identified the following significant results. The Skylab RADSCAT instrument S-193 was operated on 6 June 1973 while the spacecraft flew past Hurricane Ava in the eastern Pacific Ocean. Scatterometer returns at all polarizations and radiometer measurements were obtained from a section through the storm with winds up to 48 knots at 52 deg incident angle and 35 knots at 45.5 deg incident angle. These first hurricane scatterometer measurements indicate reasonable correlation between wind speed and backscatter, with horizontal response much stronger than the vertical response at 52 deg. Each of the sections through the hurricane contains an as yet unexplained dip in cross section at a point 200 to 300 km prior to passing the eye. The response at a point where the radiometer signal's dramatic increase indicates strong rain is also accompanied by a strong increase in the backscattered signal. No attempt has been made to make a thorough correlation of radiometric response with wind speed, but the atmospheric contribution to the radiometer signal is quite apparent.

N73-32239*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR PLANT SPECIES AND STRESS IDENTIFICATION (ERTS-A1) Progress Report
George D. Swanlund, Principal Investigator and L. Kirvida 20 Jul. 1973 2 p ERTS
(Contract NAS5-21866)
(E73-11063; NASA-CR-135519; PR-5) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-32240*# Alaska Univ., Fairbanks. Inst. of Marine Science.
CIRCULATION OF PRINCE WILLIAM SOUND Bimonthly Progress Report
Robin D. Muench, Principal Investigator 30 Sep. 1973 2 p ERTS
(Contract NAS5-21833)
(E73-11064; NASA-CR-135520; BMPR-7) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-32241*# Alaska Univ., Fairbanks.
IDENTIFICATION, DEFINITION AND MAPPING OF TERRESTRIAL ECOSYSTEMS IN INTERIOR ALASKA Bimonthly Progress Report
J. H. Anderson, Principal Investigator 30 Sep. 1973 8 p ERTS
(Contract NAS5-21833)
(E73-11065; NASA-CR-135521; BMPR-7) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Two new, as yet unfinished vegetation maps are presented. These tend further to substantiate the belief that ERTS-1 imagery is a valuable mapping tool. Newly selected scenes show that vegetation interpretations can be refined through use of non-growing season imagery, particularly through the different spectral characteristics of vegetation lacking foliage and through the effect of vegetation structure on apparent snow cover. Scenes now are available for all test area north of the Alaska Range except Mt. McKinley National Park. No support was obtained for the hypothesis that similar interband ratios, from two areas apparently different spectrally because of different sun angles, would indicate similar surface features. However, attempts to test this hypothesis have so far been casual.

N73-32242*# Alaska Univ., Palmer.
IDENTIFICATION OF PHENOLOGICAL STAGES AND VEGETATIVE TYPES FOR LAND USE CLASSIFICATION Bimonthly Progress Report
Jay D. McKendrick, Principal Investigator 1 Oct. 1973 6 p ERTS
(Contract NAS5-21833)
(E73-11066; NASA-CR-135522; BMPR-7) Avail: NTIS HC $3.00 CSCL 08F

The author had identified the following significant results. Digital signatures derived from the CDU are comparable to those taken from the printouts. Therefore, using the CDU to derive signatures should be more efficient, since there is considerable time required in turn around with the computer and time required locating vegetation stands on the printout.

N73-32243*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY Bimonthly Progress Report, 23 Jun. - 23 Aug. 1973
Duwayne M. Anderson, Principal Investigator, H. L. McKim, R. K. Haugen, L. W. Gatto, C. W. Slaughter, and T. Marlar 23 Aug. 1973 5 p refs ERTS
(NASA Order S-70253-AG)
(E73-11067; NASA-CR-135523; BMPR-5) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-32244*# Forest Research Inst., Helsinki (Finland).
DEMONSTRATION OF THE APPLICABILITY OF SATELLITE DATA TO FORESTRY Progress Report
Kullervo Kuusela, Principal Investigator 5 Oct. 1973 6 p Sponsored by NASA ERTS
(E73-11068; NASA-CR-135524; PR-2) Avail: NTIS HC $3.00 CSCL 20F

There are no author-identified significant results in this report.

N73-32245*# American Univ., Washington, D.C.
ERTS-A DATA USER INVESTIGATION OF ERTS INFORMATION SYSTEM DEVELOPMENT FOR POTOMAC RIVER BASIN NATURAL RESOURCE MANAGEMENT Progress Report, Nov. 1972 - Jun. 1973
N. H. MacLeod, Principal Investigator Jun. 1973 55 p refs ERTS
(Contract NAS5-21892)
(E73-11069; NASA-CR-135525; PR-1) Avail: NTIS HC $4.75 CSCL 08H

There are no author-identified significant in this report.

N73-32246*# Earth Satellite Corp., Berkeley, Calif.
A SCHEME FOR THE UNIFORM MAPPING AND MONITORING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES USING ERTS-1 IMAGERY Progress Report, 1 Jul. - 31 Aug. 1973
C. E. Poulton, Principal Investigator 31 Aug. 1973 11 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21830)
(E73-11070; NASA-CR-135526; PR-5) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-32247*# Geological Survey, Denver, Colo.
REMOTE SENSING GEOPHYSICS FROM SKYLAB Status Report, Sep. 1973
Kenneth Watson, Principal Investigator Sep. 1973 2 p EREP
(NASA Order T-6555-B)
(E73-11072; NASA-CR-135541) Avail: NTIS HC $3.00 CSCL

08E

There are no author-identified significant results in this report.

N73-32248*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, 1-31 Aug. 1973
William G. Hart, Sammy J. Ingle, and M. R. Davis, Principal Investigators 31 Aug. 1973 3 p EREP
(NASA Order T-4109-B)
(E73-11073; NASA-CR-135542; PR-7) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-32249*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, 1-31 Jul. 1973
William G. Hart, Sammy J. Ingle, and M. R. Davis, Principal Investigators 31 Jul. 1973 2 p EREP
(NASA Order T-4109-B)
(E73-11074; NASA-CR-135543; PR-6) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-32250*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, 1-30 Jun. 1973
William G. Hart, Sammy J. Ingle, and M. R. Davis, Principal Investigators 30 Jun. 1973 2 p EREP
(NASA Order T-4109-B)
(E73-11075; NASA-CR-135544; PR-5) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-32251*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, 1-31 May 1973
William G. Hart, Sammy J. Ingle, and M. R. Davis, Principal Investigators 31 May 1973 2 p EREP
(NASA Order T-4109-B)
(E73-11076; NASA-CR-135545; PR-4) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-32252*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, 1-30 Apr. 1973
William G. Hart, Sammy J. Ingle, and M. R. Davis, Principal Investigators 30 Apr. 1973 2 p EREP
(NASA Order T-4109-B)
(E73-11077; NASA-CR-135546; PR-3) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-32253*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Aug. 1973
Richard F. Nalepka and William A. Malila, Principal Investigators 28 Sep. 1973 2 p EREP
(Contract NAS9-13280)
(E73-11078; NASA-CR-135547; MPR-6) Avail: NTIS $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-32254*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, Sep. 1973
Harvey K. Nelson and Edgar A. Work, Jr., Principal Investigators (Environ. Res. Inst. of Mich.) 5 Oct. 1973 4 p EREP
(NASA Order T-4114-B)
(E73-11079; NASA-CR-135548) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-32255*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
DETERMINATION OF THE EARTH'S AEROSOL ALBEDO USING SKYLAB DATA Quarterly Report, 8 Jun. - 31 Aug. 1973
Robert E. Turner, Principal Investigator 25 Sep. 1973 2 p EREP
(Contract NAS9-13279)
(E73-11080; NASA-CR-135549; Rept-102200-5-L; QR-2) Avail: NTIS HC $3.00 CSCL 03B

There are no author-identified significant results in this report.

N73-32256*# Naval Research Lab., Washington, D.C.
TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Aug. 1973
Allan Shapiro, Principal Investigator 30 Sep. 1973 1 p EREP
(NASA Order T-4716-B)
(E73-11081; NASA-CR-135550) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-32257*# Purdue Univ., Lafayette, Ind. Lab. for Application of Remote Sensing.
A STUDY OF THE UTILIZATION OF ERTS-1 DATA FROM THE WABASH RIVER BASIN Bimonthly Progress Report, 1 Jul. - 31 Aug. 1973
David A. Landgrebe, Principal Investigator 31 Aug. 1973 5 p ERTS
(Contract NAS5-21773)
(E73-11082; NASA-CR-135539) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. The crop identification effort produced results indicating difficulty in discriminating cotton and soybeans in the Missouri area in the late August, September-October period. The use of prior probabilities in classification was shown to increase performance significantly. The use of temporal data was observed to improve classification accuracy for September 14 and October 2 data but not for August 26 data. Geometric correction and temporal overlay processing of ERTS-1 data proved to be very valuable for field location and relationship of fields from one time to another. Precision geometric correction of ERTS-1 data was achieved using manually derived ground control checkpoints.

N73-32258*# Tennessee Univ., Knoxville. Dept. of Plant and Soil Science.
UTILIZING ERTS IMAGERY TO DETECT PLANT DISEASES AND NUTRIENT DEFICIENCIES, SOIL TYPES AND SOIL MOISTURE LEVELS Interim Report, Mar. - Sep. 1973
W. L. Parks, Principal Investigator, J. I. Sewell, J. W. Hilty, and J. C. Rennie 29 Sep. 1973 16 p Original contains imagery. Original Photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21873)
(E73-11091; NASA-CR-135559) Avail: NTIS HC $3.00 CSCL 02C

The author has identified the following significant results. The delineation of soil associations and detection of drainage patterns, erosion and sedimentation through the use of ERTS-1 imagery are shown. Corn blight and corn virus could not be detected from ERTS-1 and detection of forest composition was at a very low probability.

N73-32259*# Earth Satellite Corp., Berkeley, Calif.
ERTS DATA USER INVESTIGATION TO DEVELOP A MULTISTAGE FOREST SAMPLING INVENTORY SYSTEM Progress Report, Feb. - Sep. 1973
Philip G. Langley and J. W. VanRoessel, Principal Investigators 25 Sep. 1973 37 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21853)
(E73-11092; NASA-CR-135560) Avail: NTIS HC $4.00 CSCL 02F

The author has identified the following significant results. A unique digital timber volume estimation system was developed for use with the MSS CCT tapes. The system was tested on a 64-square mile area in Northern California's Trinity Alps. The outcome of a systematic experiment, in which several possible combinations of bands 5 and 7 and a contrast measure were tried, showed that an estimated gain in precision of 50% can be obtained in a multistage sampling design. The difference between bands 5 and 7 proved to be of special importance for the estimation of biomass in the form of timber volume. In addition, an interpretation model for high flight U2 photographs was developed. A maximum multiple correlation coefficient of 0.74 was obtained for the regression model, explaining 55% of the variation in timber volume as estimated from aerial photos and ground measurments. An interpretation model for MSS color composites is in the testing stage.

N73-32260*# Earth Satellite Corp., Berkeley, Calif.
EVALUATION OF USEFULNESS OF SKYLAB EREP S-190 AND S-192 IMAGERY IN MULTISTAGE FOREST SURVEYS Progress Report, 1 Aug. - 30 Sep. 1973
Philip G. Langley, Principal Investigator 30 Sep. 1973 5 p EREP
(Contract NAS9-13289)
(E73-11093; NASA-CR-135561; PR-5) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. A unique digital timber volume estimation system with digital data for two ERTS-1 MSS bands was tested. The system was tested on a 64-square mile area in Northern California's Trinity Alps. The outcome of a systematic experiment in which possible combinations of the two bands (MSS 5 and 7) were tried, showed than an estimated gain in precision of 50% can be obtained in a multistage sampling design. Especially the difference between the two bands proved to be of major importance for the estimation of biomass in the form of timber volume. Identical tests as the one performed will be conducted with various S-192 bands when the digital data become available.

N73-32261*# Mississippi State Univ., State College. Inst. for Environmental Studies.
APPLICATION OF ERTS-A DATA TO AGRICULTURAL PRACTICES IN THE MISSISSIPPI DELTA REGION Interim Report, Apr. - Oct. 1973
C. W. Bouchillon, Principal Investigator, F. M. Ingels, and R. W. Boyd Oct. 1973 9 p ERTS
(Contract NAS5-21881)
(E73-11094; NASA-CR-135562) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-32262*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Progress Report, Sep. 1973
George A. Maul, Principal Investigator Sep. 1973 2 p EREP (NASA Order T-4713-B)
(E73-11095; NASA-CR-135563; MPR-3) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-32263*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF ATMOSPHERIC EFFECTS IN SKYLAB DATA
Frederick J. Thomson, Principal Investigator 8 Oct. 1973 3 p EREP
(Contract NAS9-13272)
(E73-11118; NASA-CR-135621; ERIM-101700-8-L; QPR-2) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-32264*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
[MULTIDISCIPLINARY INVESTIGATIONS UTILIZING ERTS-1 DATA] Bimonthly Report, 1 Jul. - 31 Aug. 1973
Frederick J. Thomson, F. C. Polcyn, M. Leonard Bryan, I. J. Sattinger, W. A. Malila, R. F. Nalepka, C. T. Wezernak, R. Horvath, and R. K. Vincent, Principal Investigators 19 Sep. 1973 101 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21783)
(E73-11119; NASA-CR-135622; ERIM-193300-24-L; BMR-6) Avail: NTIS HC $7.25 CSCL 05B

There are no author-identified significant results in this report.

N73-32265*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOID AND FREE AIR GRAVITY ANOMALIES CORRESPONDING TO THE GEM-4 EARTH GRAVITATIONAL MODEL
J. G. Marsh, F. J. Lerch, and S. F. Vincent (Computer Sciences Corp.) Feb. 1973 11 p refs
(NASA-TM-X-66240; X-592-73-58) Avail: NTIS HC $3.00 CSCL 03B

Contour maps are presented of the global geoid. Free air gravity anomalies of the GEM-4 earth gravitational model are also included. Author

N73-32266*# Minnesota Univ., Minneapolis. Space Science Center.
A STUDY OF MINNESOTA FORESTS AND LAKES USING DATA FROM EARTH RESOURCES TECHNOLOGY SATELLITES Annual Progress Report, 1 Jul. 1972 - 30 Jun. 1973
30 Jun. 1973 93 p refs
(Grant NGL-24-005-263)
(NASA-CR-135565) Avail: NTIS HC $6.75 CSCL 08F

Summaries covering the use of ERTS data to aid in determining surface water transport in lakes, defoliation of crops, air pollution, and snowmelt floods in Minnesota are presented. For individual titles, see N73-32267 through N73-32271.

N73-32267* Minnesota Univ., Minneapolis. Dept. of Physics.
REMOTE SENSING IN LAKE SUPERIOR STUDIES
Michael Sydor *In its* A study of Minn. Forests and Lakes using Data from ERTS 30 Jun. 1973 p 1-70 refs (For availability see N73-32266 23-13)
CSCL 08H

An investigation was made of surface water transport in the extreme western arm of Lake Superior from July 25 to September 15, 1972. Temperature and water velocity profile measurements were made to determine the nature of currents at the tip of the lake. Bathythermographs and thermistor probes were used for these measurements. From the end of July to August 9, no pronounced steady stratification took place. A series of days with variable winds produced, under N.E. winds, warm water pileup at the tip of the lake, which was subsequently driven out by westerly winds. Some evidence of upwelling was indicated by cold surface waters near the shore. After August 9 considerable stratification with slight upwelling was noted.
E.H.W.

N73-32268* Minnesota Univ., Minneapolis. Coll. of Forestry.
AERIAL PHOTOGRAPHY: USE IN DETECTING SIMULATED INSECT DEFOLIATION IN CORN
H. C. Chiang, Robert Latham, and Merle P. Meyer *In its* A study of Minn. Forests and Lakes using Data from ERTS 30 Jun. 1973 p 71-76 refs Repr. from J. Econ. Entomol., v. 66, no. 3, Jun. 1973 p 779-784 (For availability see N73-32266 23-13)
(Paper-8076) CSCL 02C

Artificial defoliation in corn was used to explore the usefulness of aerial photography in detecting crop insect infestations. Defoliation on the top of plants was easily detected, while that on the base was less so. Aero infrared film with Wratten 89B filter gave the best results, and morning flights at the scale of 1:15840 are recommended. Row direction, plant growth stage, and time elapse since defoliation were not important factors. Author

N73-32269* Minnesota Univ., Minneapolis. Dept. of Environmental Health.
FEASIBILITY OF DETECTING MAJOR AIR POLLUTANTS BY EARTH ORIENTED SATELLITE-BORNE SENSORS
Harold J. Paulus and David W. Hoffman *In its* A Study of Minn. Forests and Lakes using Data from ERTS 30 Jun. 1973 p 77 (For availability see N73-32266 23-13)
CSCL 04B

An attempt was made to use ERTS-1 MSS imagery to aid in evaluating air pollution around the Minnesota area. Data are correlated with local measurements. Injuries to forest and crop vegetation were also evaluated. E.H.W.

N73-32270* Minnesota Univ., Minneapolis.
USE OF REMOTE SENSING IN THE ANALYSIS OF SNOWMELT FLOODS
C. Edward Bowers *In its* A Study of Minn. Forests and Lakes using Data from ERTS 30 Jun. 1973 p 78-85 (For availability see N73-32266 23-13)
CSCL 08L

An evaluation was made of remote sensing data, particularly ERTS imagery, in an effort to establish its suitability as an aid in determining percent of snow cover and water content of snow on the ground. Resulting data are used with mathematical simulation models to forecast spring snowmelt floods. Author

N73-32271* Minnesota Univ., Minneapolis. Dept. of Geology.
A PROPOSAL FOR PRECAMBRIAN MINERAL RESOURCE EVALUATION IN MINNESOTA UTILIZING ERTS IMAGERY
Donald Davidson, Jr. *In its* A study of Minn. Forests and Lakes using Data from ERTS 30 Jun. 1973 p 86-87 (For availability see N73-32266 23-13)
CSCL 08G

An investigation was made of Minnesota. These rock units hold promise for potential mineral resources as do important ore deposits found in similar rocks to the north in Canada. The research planned involves the discrimination of rock types to show their aerial extent and an interpretation of the structural relationships between and within the various rock units. Author

N73-32272# Department of the Environment, Ottawa (Ontario). Marine Sciences Directorate.
[TSUNAMI PROPAGATION DATA COMPUTATIONS] Manuscript Report Series No. 28
1972 82 p refs
Avail: NTIS HC $6.25

Tsunami investigations in Canada are examined, including wave propagation on west coast and resonance periods of multibranched inlet with wave amplification. For individual titles, see N73-32273 through N73-32274.

N73-32273 Department of the Environment, Ottawa (Ontario).
SOME TSUNAMI STUDIES FOR THE WEST COAST OF CANADA
T. S. Murty and R. F. Henry *In its* Tsunami Propagation Data Computations 1972 p 1-46 refs (For availability see N73-32272 23-13)

The propagation of a tsunami into the Fisher-Fitz Hugh complex on the west coast of Canada was computed, taking the topography into account. The importance of resonance in tsunami amplification was considered, particularly in the Juan de Fuca Strait and the Cousins Inlet. The tide gage data for the 1964 Alaska earthquake tsunami was evaluated through performing autocorrelogram analysis and calculation of autospectra. To evaluate the nonlinear coastal effects, the bispectra were computed. The energy processes on the continental shelf off Tofino were also examined. Author

N73-32274 Department of the Environment, Ottawa (Ontario).
RESONANCE PERIODS OF MULTI-BRANCHED COASTAL INLETS WITH TSUNAMI AMPLIFICATION
R. F. Henry and T. S. Murty *In its* Tsunami Propagation Data Computations 1972 p 47-79 refs (For availability see N73-32272 23-13)

Difficulties are examined which arise when resonance frequencies are computed for multibranched inlets by iterative search for successive normal modes. It is shown that unless the boundary conditions are applied to each mode in an appropriate manner, spurious modes of oscillation may appear during the numerical computation and further, genuine modes may be overlooked. These spurious modes are spurious only with reference to the entire system, but they are probably close to certain resonant modes for some branch of the system. Essentially, the initial and final boundary conditions should be applied in branches of the system where there is appreciable motion. Author

N73-32275*# Texas A&M Univ., College Station. Remote Sensing Center.
MICROWAVE EMISSION AND SCATTERING FROM VEGETATED TERRAIN
Terrell Gene Sibley Aug. 1973 162 p refs
(Grant NGL-44-001-001)
(NASA-CR-135593; RSC-44) Avail: NTIS HC $10.25 CSCL 08F

Models are developed for the apparent temperature and backscattering coefficient of vegetated terrain to illustrate the effects of vegetation on the sensitivity of these parameters to variations of soil moisture. Three types of terrain are simulated for both the passive and the active case: a uniform canopy over a smooth surface, plant rows on a smooth surface, and plant rows on a rough surface. In each case the canopy is defined by its overall dimensions and by its electric permittivity, which is determined from Weiner model for dielectric mixture. Emission and scattering from both the soil and the canopy are considered, but atmospheric effects are neglected. Calculated data indicate that the sensitivity of the apparent temperature and backscattering coefficient to variations of soil moisture, decreases as the amount of vegetation increases. It is shown that the same effect results from increasing signal frequency or angle of incidence. Author

N73-32276# Illinois Univ., Urbana. Aeronomy Lab.
ELECTRON COLLISION PROCESSES IN THE IONOSPHERE Preliminary Information
G. P. Mantas 1 Sep. 1973 377 p refs
(Grant NSF GA-25660; NSF GA-36911)
(UILU-ENG-73-2504; Aeronomy-54) Avail: NTIS HC $21.00 CSCL 04A

The rate of energy exchange, through elastic collisions, between two gases in thermal disequilibrium, is derived from elementary considerations. This formula is applied to calculate energy transfer rates, and collision frequencies for transfer, in plasmas at thermal disequilibrium. It is shown that electron/ion energy transfer rates and collision frequencies for energy transfer are overestimated by 5 to 37%, depending on the electron density and electron and ion temperatures, when the classical Coulomb logarithm 1n Lambda appears in these expressions. A more accurate cross section for Coulomb collisions (than that obtained when the shielded potential is truncated at the Debye length) leads to a correction term for 1n Lambda. Electron/electron and ion/ion collision frequencies and relaxation times differ from the usual expressions for these quantities by as much as a factor of two. Mean experimental, and theoretical electron/neutron momentum transfer cross sections for N2, O2, O, He and H are used to obtain simple formulas for energy transfer and collision frequencies useful for electron gas temperature calculations. Author

N73-32277*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AN EXPERIMENTAL INVESTIGATION OF MESOSPHERIC IONIZATION
John D. Mitchell 29 Jun. 1973 112 p refs
(Grant NGR-39-009-015; Contract DAHC04-68-C-0034)
(NASA-CR-135637; PSU-IRL-SCI-416) Avail: NTIS HC $7.75

CSCL 04A

Mesospheric ionization and its variability are examined. Data were obtained primarily by the parachute-borne blunt probe technique conducted in coordinated rocket experiments at White Sands Missile Range, New Mexico and Wallops Island, Virginia. Electrical conductivity measurements and deduced charge density values from ten rocket launches are presented and discussed. Positive ion conductivity and electron density were found to be relatively invariant with height between 45 and 60 km. Variations in positive conductivity of a factor of two and enhancements in negative conductivity by as much as a factor of four were measured by the blunt probe. A simple lumped parameter ion chemistry model is shown to satisfactorily explain the charge density values for the undisturbed lower D-region. Implications of the data in terms of this model are considered. The principal loss mechanism for positive ions in the 45 to 60 km. region is concluded to be dissociative recombination. Electron densities deduced from the conductivity data are explained by detachment involving a minor neutral constituent which is mixed between 65 and 45 km. and then cuts off sharply below 45 km. A correlation study involving blunt probe measurements shows relatively good agreement between variations in positive conductivity and temperature.

Author

N73-32278*# Alaska Univ., College. Geophysical Inst.

ANALYSIS OF AURORAL DATA FROM NASA'S 1968 AND 1969 AIRBORNE AURORAL EXPEDITION Semiannual Report

Jun. 1973 94 p refs

(Grant NGR-02-001-099)

(NASA-CR-135497) Avail: NTIS HC $6.75 CSCL 04A

Results of a methodical compilation, reduction, and correlated analysis of spectrophotometric data obtained by various scientific groups during NASA's 1968 and 1969 Airborne Auroral Expedition are presented.

Author

N73-32279*# Colorado School of Mines, Golden. Dept. of Geology.

REMOTE SENSING AIDS GEOLOGIC MAPPING

Daniel H. Knepper, Jr. and Ronald W. Marrs Oct. 1972 11 p refs Repr. from Proc. of the 8th Intern. Symp. on Remote Sensing of Environment p 1127-1136

(Grant NGL-06-001-015)

(NASA-CR-135636; Rept-72 8) Avail: NTIS HC $3.00 CSCL 08G

Remote sensing techniques were applied to general geologic mapping along the Rio Grande rift zone in central Colorado. A geologic map of about 1,100 square miles was prepared utilizing (1) prior published and unpublished maps, (2) detailed and reconnaissance field maps made for this study, and (3) remote sensor data interpretations. The map is used for interpretation of the complex Cenozoic tectonic and geomorphic histories of the area.

Author

N73-32280*# Hale Observatories, Pasadena, Calif.

INFRARED EMISSION FROM THE SOUTHERN H 2 REGION H2-3

E. E. Becklin, J. A. Frogel, D. E. Kleinmann, Neugebauer, S. E. Persson, and C. G. Wynn-Williams 1973 16 p refs

(Grant NGL-05-002-207)

(NASA-CR-135640) Avail: NTIS HC $3.00 CSCL 04A

The H 2 region H2-3 has been found to have a large infrared flux with a luminosity of 100,000 to 200,000 solar luminosity between 1.65 and 25 microns. Most of this flux comes from a single component with the diameter of 110 in; (2 pc). At 2.2 microns there is an unresolved source which is identified as the exciting star of the nebula; it can provide the required ionization and the total luminosity observed at infrared wavelengths. The 3- to 25- microns radiation is shown to be consistent with dust heated by L alpha radiation within the nebula, but much of the 40- to 350- microns radiation probably originates from outside the H 2 region.

Author

N73-32281*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.

[AURORAL DATA FROM MICHIGAN AIRGLOW PAYLOAD LAUNCH] Final Report, 1 Jul. 1972 - 31 Aug. 1973

Paul B. Hays and William E. Sharp Aug. 1973 6 p refs

(Grant NGR-23-005-360; ORA Proj. 033390)

(NASA-CR-135718; FR-033390-4-F) Avail: NTIS HC $3.00 CSCL 04A

Auroral studies are presented of flight data analysis from the Michigan airglow payload. Analysis of the stellar occultation data and results from the twilight flight are reported. Optical emissions from bottled aurora and an electron analyzer for measurement of distributions in energy of electrons along a beam are also presented. A list of related publications is included.

T.M.R.

N73-32282*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT Annual Report, 1 Jun. 1972 - 1 Jun. 1973

I. J. Sattinger, A. N. Sellman, L. B. Istvan, and J. J. Cook Jul. 1973 62 p refs Original contains color illustrations

(Grant NGR-23-005-552)

(NASA-CR-135639; ERIM-193400-2-F) Avail: NTIS HC $5.25 CSCL 08F

During the period from June 1972 to June 1973, remote sensing techniques were applied to the following tasks: (1) mapping Michigan's land resources, (2) waterfowl habitat management at Point Mouillee, (3) mapping of Lake Erie shoreline flooding, (4) highway impact assessment, (5) applications of the Earth Resources Technology Satellite, ERTS-1, (6) investigation of natural gas eruptions near Williamsburg, and (7) commercial site selection. The goal of the program was the large scale adaption, by both public agencies and private interests in Michigan, of earth-resource survey technology as an important aid in the solution of current problems in resources management and environmental protection.

Author

N73-32283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NIGHTTIME ION COMPOSITION MEASUREMENTS AT THE GEOMAGNETIC EQUATOR

R. A. Goldberg and A. C. Aikin Oct. 1973 26 p refs

(NASA-TM-X-70476; X-625-73-290) Avail: NTIS HC $3.50 CSCL 04A

Two ion composition profiles, representative of the nighttime equatorial ionosphere between 90 km and 300 km, are presented. These profiles were obtained by two rocket-borne ion mass spectrometers on a single night for solar zenith angles of 112 deg and 165 deg. For both flights, the principal ion above 200 km is O(+). The downward drift of the atomic ions O(+) and N(+), coinciding with the postsunset lowering of the F2 peak, is observed through an enhancement of the density of O(+) at altitudes above 200 km and N(+) above 240 km. Below the drift region, O(+) and N(+) are observed in concentrations larger than expected. The NO(+) altitude distribution retains its shape throughout the night, and below 210 km, is the principal ion. The behavior of O2(+) can be explained by the O(+), electron density and theoretical neutral nitric oxide concentrations. Light metallic ions, including Mg(+), Na(+), and possibly Si(+), are observed to altitudes approaching 300 km and are affected by vertical drift.

Author

N73-32284*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DIURNAL POLAR MOTION

Paul McClure Sep. 1973 114 p refs

(NASA-TM-X-70470; X-592-73-259) Avail: NTIS HC $7.75 CSCL 03C

An analytical theory is developed to describe diurnal polar motion in the earth which arises as a forced response due to lunisolar torques and tidal deformation. Doodson's expansion of the tide generating potential is used to represent the lunisolar torques. Both the magnitudes and the rates of change of perturbations in the earth's inertia tensor are included in the dynamical equations for the polar motion so as to account for rotational and tidal deformation. It is found that in a deformable earth with Love's number k = 0.29, the angular momentum vector departs by as much as 20 cm from the rotation axis rather than remaining within 1 or 2 cm as it would in a rigid earth. This 20 cm separation is significant in the interpretation of submeter polar motion observations because it necessitates an additional coordinate transformation in order to remove what

would otherwise be a 20 cm error source in the conversion between inertial and terrestrial reference systems. Author

N73-32285*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SOMALI CURRENT AND THE SOUTHWEST MONSOON: AN OCEAN ATMOSPHERE INSTABILITY
John C. Price Sep. 1973 10 p refs Submitted for publication
(NASA-TM-X-70471; X-651-73-278) Avail: NTIS HC $3.00 CSCL 04A

The Somali current and the southwest monsoon are identified as arising from an ocean atmosphere instability which is associated with the low latitude variation of the Coriolis force. Data on the fall of isotherms, surface wind speed, ocean response to frictional force, and upwelling of cold water are discussed. J.A.M.

N73-32286*# Texas Univ., Dallas.
OGO 6 ION CONCENTRATION IRREGULARITY STUDIES Final Report
J. P. McClure Sep. 1973 91 p refs
(Contract NAS5-23184)
(NASA-CR-132814) Avail: NTIS HC $6.75 CSCL 04A

Research is reported concerning the ionospheric F-region irregularities. The results are based on in-situ OGO-6 measurements of the total ion concentration N sub i. A proposed mechanism for the generation of equatorial F-region irregularities and the morphological results, and the occurrence of Fe(+) ions in the equatorial F-region are discussed. Related research papers are included. F.O.S.

N73-32287*# St. Louis Univ., Mo.
MARTIAN THERMAL BOUNDARY LAYERS: SUBHOURLY VARIATIONS INDUCED BY RADIATIVE-CONDUCTIVE HEAT TRANSFER WITHIN THE DUST-LADEN ATMOSPHERE-GROUND SYSTEM
A. J. Pallmann, W. P. Dannevik, and S. P. Frisella Washington NASA Oct. 1973 91 p refs
(Grant NGL-26-006-016)
(NASA-CR-2318; PLATMOS-RR-8) Avail: NTIS HC$3.75 CSCL 03B

Radiative-conductive heat transfer has been investigated for the ground-atmosphere system of the planet Mars. The basic goal was the quantitative determination of time dependent vertical distributions of temperature and static stability for Southern-Hemispheric summer season and middle and polar latitudes, for both dust-free and dust-laden atmospheric conditions. The numerical algorithm which models at high spatial and temporal resolution the thermal energy transports in the dual ground-atmosphere system, is based on solution of the applicable heating rate equation, including radiative and molecular-conductive heat transport termsj The two subsystems are coupled by an internal thermal boundary condition applied at the ground-atmosphere interface level. Initial data and input parameters are based on Mariner 4, 6, 7, and 9 measurements and the JPL Mars Scientific Model. Numerical experiments were run for dust-free and dust-laden conditions in the midlatitudes, as well as ice-free and ice-covered polar regions. Representative results and their interpretation are presented. Finally, the theoretical framework of the generalized problem with nonconservative Mie scattering and explicit thermal-convective heat transfer is formulated, and applicable solution algorithms are outlined. Author

N73-32288# National Oceanographic Data Center, Washington, D.C. National Data Buoy Center.
ENVIRONMENTAL CONDITIONS WITHIN SPECIFIED GEOGRAPHIC REGIONS: OFFSHORE EAST AND WEST COAST OF THE UNITED STATES AND IN THE GULF OF MEXICO
Apr. 1973 752 p
(NOAA-NDBC Order P18-17)
Avail: NTIS HC $39.75

Data and information are presented for the benefit of those in the marine engineering field in general, and the NOAA Data Buoy Office (NDBO) personnel in particular, and as a base for anticipated future data from buoys. Matrices and graphical presentations of observed data and existing summaries are produced here to assist in the decision-making processes required of the NDBO engineers and planners. The work is faithful to the requirements for optimum decision-making in the design, development, testing, and deployment of buoys and buoy-mountad sensors. Author

N73-32289*# Scientific Translation Service, Santa Barbara, Calif.
NEW PROBLEMS OF BALL LIGHTNINGS
M. T. Dmitriyev Washington NASA Oct. 1973 25 p refs Transl. into ENGLISH from Priroda (USSR), no. 4, 1973 p 60-67
(Contract NASw-2483)
(NASA-TT-F-15097) Avail: NTIS HC $3.25 CSCL 04A

Detailed descriptions are given of observations of ball lightning. The possible sources of energy for ball lightning are discussed. These are self-sustaining chemical reactions of the direct oxidation of nitrogen, the nuclear reaction of atmospheric xenon, and the annihilation of matter with antimatter. No definite conclusions are reached. Author

N73-32290*# Scientific Translation Service, Santa Barbara, Calif.
IS THERE IRON FROM SPACE ON EARTH?
M. I. Kalganov Washington NASA Oct. 1973 13 p refs Transl. into ENGLISH from Priroda (Moscow), no. 7, Jul. 1972 p 64-67
(Contract NASw-2483)
(NASA-TT-F-15121) Avail: NTIS HC $3.00 CSCL 08G

The probable reason for the enormous accumulation and exclusive occurrence of ferruginous quartzite in Precambrian rock is discussed. The earth in Precambrian times, i.e., the Archaic and Proterozoic, repeatedly passing through the iron dust clouds in the Milky Way as our solar system rotated around the center of our Galaxy for a period of several million years, was covered with an enormous amount of very fine iron particles which became the principal source of the deposits of ferruginous quartzites in precambrian time. The second source was iron washed by erosion or weathering into the Precambrian water basins, and the third source was underwater volcanic eruptions. Author

N73-32291# National Environmental Satellite Service, Washington, D.C.
SATELLITE INFRARED SOUNDINGS FROM NOAA SPACECRAFT
L. M. McMillin, D. Q. Wark, J. M. Siomkajilo, P. G. Abel, A. Werbowetzki, L. A. Lauritson, J. A. Pritchard, D. S. Crosby, H. M. Woolf, R. C. Luebbe et al Sep. 1973 117 p refs
(NOAA-TR-NESS-65) Avail: SOD $1.30

Data are currently being received from a vertical temperature profile radiometer aboard the NOAA 2 spacecraft to produce operational atmospheric soundings of temperature and humidity on a global scale. This report describes the VTPR instrument, its calibration, the procedure to obtain clear radiance from cloud contaminated radiance measurements, retrieval techniques used to obtain temperature and humidity profiles from clear radiances, the quality checks performed on these profiles, and the various forms in which data are available to potential users. Author

N73-32292# Joint Publications Research Service, Arlington, Va.
THE INFORMATION CAPACITY OF THE GRADIENT METHOD OF MEASURING THE EARTH'S MAGNETIC FIELD
Ye. N. Roze 21 Sep. 1973 5 p ref Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 13, no. 4, 1973 p 762-764
(JPRS-60100) Avail: NTIS HC $3.00

An article is given on the information capacity of the gradient method of measuring the earth's magnetic field. Author

N73-32293*# National Aeronautics and Space Administration, Washington, D.C.
AURORAL BREMSSTRAHLUNG AT BALLOON ALTITUDES
Stephen M. Seltzer (NBS), Martin J. Berger (NBS), and Theodore Rosenberg (Md. Univ.) 1973 28 p refs
(NASA-SP-3081) Avail: NTIS HC $3.00 CSCL 04A

Data from a Monte Carlo calculation of the transport of electrons and secondary bremsstrahlung are presented in tabular

and graphical form. These data describe bremsstrahlung flux spectra at various atmospheric depths between 30 g/sq cm and 15.0 g/sq cm caused by wide-area uniform precipitation into the atmosphere of electrons with energies between 30 and 2000 keV. The angular distribution of the incident electrons has been assumed to be isotropic over the downward hemisphere. A basic set of results is given for incident monoenergetic electron beams, which can be used to treat incident electron beams with any spectrum of interest. A comprehensive set of results in the form of differential and integral-bremsstrahlung flux spectra has been obtained for the case of electron beams with exponential energy spectra, for e-folding energies between 5 and 200 keV. Author

N73-32294*# Scripta Technica, Inc., Washington, D.C.
THE DYNAMICS OF LONGITUDINAL (FIELD-ALIGNED) CURRENTS IN THE MAGNETOSPHERE
V. A. Gudkova NASA Oct. 1973 17 p refs Transl. into ENGLISH from Academy of Sciences, Moscow, Institute for Space Research report no. Pr-83, 1971 24 p
(Contract NASw-2484)
(NASA-TT-F-15075; Pr-83) Avail: NTIS HC $3.00 CSCL 04A

The temporal evolution is presented of ion-sound turbulence in the earth's magnetosphere. The origin of the turbulence is associated with currents and electric fields along geomagnetic field lines. The anomalous dissipation of the longitudinal currents caused by turbulence is the source of gradual heating of the plasma. The damping of short-period oscillations of the magnetic field, corresponding to MHD-waves in the magnetosphere, may serve as a diagnostic measure of this phenomenon. As calculations show, the damping should decrease with an increase in plasma temperature, and, consequently, with time. The damping decrement of short-period oscillations observed on the background of sufficiently intense bays is analyzed, and it is observed that the damping does tend to decrease with time. Author

N73-32295*# Scientific Translation Service, Santa Barbara, Calif.
ORGANIC GEOCHEMISTRY OF AMINO ACIDS IN SEDIMENTARY ROCKS
Masahiko Akiyama Washington NASA Jul. 1973 29 p refs Transl. into ENGLISH from Chikyu, Kagaku (Tokyo), v. 26, no. 3, 1972 p 120-131
(Contract NASw-2483)
(NASA-TT-F-14986) Avail: NTIS HC $3.50 CSCL 08G

A review is given of the amino acid distribution and of the diagenetic fates of proteins in recent and ancient sediments. The diagenetic process of the organic compounds in sediments differs from that in fossils in the following two aspects: (1) the protein in sediments is suffered by active bacterial destruction especially under oxidizing conditions; and (2) the resulting hydrolysates (amino acids) are polymerized with the other organic compound therein such as carbohydrate, lignin or fat, producing humic acid or kerogen in sediments. Most of the survival amino acids in the ancient sediments are derived from the kerogen or humic acid, which may give the similar composition to the original protein at its deposition. It is suggested that the depositional environment can be inferred from the amino acid composition in the ancient sediments. Author

N73-32296# California Univ., Livermore. Lawrence Livermore Lab.
DOT-CIAP PROGRAM Annual Report
M. C. MacCracken 13 Feb. 1973 220 p refs
(Contract W-7405-eng-48)
(UCRL-51336; AR-1) Avail: NTIS HC $7.60

Research projects to determine the effects of large numbers of aircraft operating in the stratosphere on global and local climatic conditions are discussed. The projects are concerned with developing models to show: (1) global kinetics and transport, (2) zonal atmospheric conditions, (3) stratospheric conditions, (4) radiation transport, and (5) meteorological conditions. Mathematical models are developed to analyze the dispersion of the aircraft exhaust plume under various conditions. The chemical reactions of the exhaust plume with atmospheric constituents are discussed. Author (NSA)

N73-32297# Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. fuer Meteorologie.
COMPARISON OF MEASURED AND CALCULATED ATMOSPHERIC TRANSMISSION SPECTRA IN THE SPECTRAL REGION OF 3.9 MICROMETERS [EIN VERGLEICH GEMESSENER UND BERECHNETER TRANSMISSIONSSPEKTREN DER ATMOSPHAERE IM SPEKTRALBEREICH BEI 3,9 MICROMETERS]
P. Wendling and H. J. Bolle Bonn Bundeswhramt 1973 83 p refs
(BMVg-FBWT-73-11) Avail: NTIS HC $6.25; Bundeswehramt 25 DM

An infrared grating spectrometer for high resolution atmospheric transmittance measurements is described. The continuum extinction coefficient, near 3.2 micron wavelength range, for different atmospheric water vapor and aerosol content was determined using regression analysis. Absorption due to CO2 and N2 was considered. Laboratory measurements were carried out to get precise information on N2O spectral line data. The separation method, as well as the comparison of calculated and measured spectra, are mainly based on these laboratory data - data of radio sonde ascents and visual range estimations made by airports situated near by. Calculated and measured spectra agreed for a height constant N2O-volume mixing ratio of (0.30 for -0.03) 1 million. ESRO

N73-32298# Istituto di Fisica Dell Atmosfera, Rome (Italy).
THERMAL SURVEYS ON GARDA LAKE USING INFRARED EQUIPMENT
M. Giorgi, M. Colacino, and F. M. Vivona Jan. 1973 54 p refs In ITALIAN; ENGLISH summary
(IFA-STR-23) Avail: NTIS HC $4.75

Annual variations of the Garda Lake surface temperature were studied by bolometric measurements using helicopter-borne devices. Superficial isotherms were derived for two sets of flights performed in different months. Thermal anomalies of morning-evening inversions were analyzed. Earth based thermograms obtained by using the thermovision instrument are presented and compared to bolometer measurements. ESRO

N73-32299# Plessey Co., Ltd., Havant (England).
MULTISPECTRAL SCANNING SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH RESOURCE SURVEYS. VOLUME 7: BIBLIOGRAPHY
Jun. 1973 82 p refs
(Contract ESTEC-1673/72-EL)
(ERL/R-249-U; ESRO-CR(P)-237) Avail: NTIS HC $6.25

The bibliography includes the following areas data: processing, material properties of vegetation and soils, agriculture, geography, geology, hydrology, and oceanography. For vol. 1, see 92077; Vol. 2, 92078; Vol. 3, 92553; Vol. 4, 92552; Vol. 5, 92701, and Vol. 6, 92777. ESRO

N73-32300# World Meteorological Organization, Geneva (Switzerland).
ENVIRONMENTAL FACTORS IN OPERATIONS TO COMBAT OIL SPILLS
L. Otto 1973 32 p refs
(WMO-359; MAS-9) Avail: NTIS HC $3.75

To combat oil spills effectively, knowledge of the rate and direction of spill movement is required, the latter being determined by winds, waves, and currents, as well as by the physical and chemical properties of oil and water. These aspects are discussed, and factors to be taken into account in developing forecast procedures are also indicated. ESRO

N73-32301# Plessey Co., Ltd., Havant (England).
MULTISPECTRAL SCANNING SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH RESOURCE SURVEYS. VOLUME 5: RECOMMENDATIONS FOR EUROPEAN PROGRAMME
A. D. Higham, Q. S. Earl, D. A. Kahn, E. Fitzgerald, and P. B. Wilkinson Mar. 1973 119 p refs
(Contract ESTEC-1673/72-EL)
(ERL/R-247-U; ESRO-CR(P)-235) Avail: NTIS HC $8.00

The implications of multispectral scanning system (MSS) are discussed. Discussion and programs for the extension of European capabilities in the areas of the basic sensing process, the properties

of materials, the MSS instrument, data processing, earth science application, ground truth and education are presented. Both aircraft and satellite carried sensors are considered. The final section identifies the specific programs with some indication of what their content might be and ends with tables of associated cost and program timing estimates. ESRO

N73-32302# Danish Meteorological Inst., Charlottenlund.
GODHAVN, GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS, 1966
1973 58 p refs
(ISBN-87-7478-066-2) Avail: NTIS HC $5.00

Regular recordings of the three magnetic elements H, D, and Z were made at Godhavn Geophysical Observatory during 1966, by means of three sets of photographic variometers, two standard magnetographs (sensitive and insensitive) and a quick-run magnetography. The determination of baseline values and reduction formulae are given. ESRO

N73-32303# Danish Meteorological Inst., Charlottenlund.
THULE GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS, 1966
1973 57 p refs
(ISBN-87-7478-069-7) Avail: NTIS HC $5.00

Regular recordings of the three magnetic elements H, D, and Z were made at Thule Geophysical Observatory during 1966, by means of three sets of photographic variometers: two standard magnetographs sensitive and insensitive) and a quick-run magnetograph. The determination of the baseline values and reduction formulae are given. ESRO

N73-32304# Geological Survey, Denver, Colo.
FORTRAN 4 PROGRAMS FOR THE DETERMINATION OF THE TRANSIENT TANGENTIAL ELECTRIC FIELD AND VERTICAL MAGNETIC DIPOLE FOR AN M-LAYER STRATIFIED EARTH BY NUMERICAL INTEGRATION AND DIGITAL LINEAR FILTERING Final Report
Walter L. Anderson Jun. 1973 85 p refs
(PB-221240/5; USGS-GD-73-017) Avail: NTIS HC $4.85 CSCL 08N

IBM System 360/65 FORTRAN 4 programs are presented for numerically computing Hankel transforms and Fourier cosine transforms to obtain the transient tangential electric field and vertical magnetic field about a vertical magnetic dipole for an m-layer stratified earth model. Two independently developed programs are discussed, where numerical integration methods are compared with digital linear filtering methods. Program listings are provided along with example problems run by both methods. Author (GRA)

N73-32305# Woods Hole Oceanographic Institution, Mass. Dept. of Geophysics.
ADVANCE MARINE TECHNOLOGY Technical Progress Report, 1 Aug. 1972 - 31 Jan. 1973
Thomas C. Aldrich, Robert D. Ballard, Carl O. Bowin, Frederick R. Hess, Bruce P. Luyendyk, Marvin J. McCamis, William M. Marquet, Joseph D. Phillips, Dave L. Porter, Allyn C. Vine et al
1 Jun. 1973 58 p
(Contract N00014-71-C-0284; NR Proj. 293-008)
(AD-763372; WHOI-73-37) Avail: NTIS CSCL 13/10

This is a progress report for the period 1 August 1972 - 31 January 1973 on the following projects in advanced marine technology: (a) submerged navigation and submersible instrumentation; (b) handling and transfer at sea; (c) bottom reconnaissance and detailed site survey by research submersible; (d) near bottom magnetics studies using a deep submersible; (e) near bottom gravity studies from a deep submersible; (f) a self contained deep sea rock drill; (g) self contained ancillary modular platform (SCAMP); (h) modular acoustic system; (i) air-seas system (Long Range Echo Ranging). Author (GRA)

N73-32306# Naval Research Lab., Washington, D.C.
RESOLUTION OF POINT SCATTERERS BY HARD-LIMITED SYNTHETIC APERTURE RADAR Final Report
George C. Georges Jun. 1973 34 p refs
(NRL Proj. R07-02; RR0210141)
(AD-763660; NRL-7566) Avail: NTIS CSCL 08/2

Image maps of collections of point targets are investigated for hard-limited synthetic aperture radar application. Some aspects of hard-limiting, such as image suppression and spurious image generation, are derived under specialized weak-scatterer assumptions. Also, the effect of random variations of target phases on synthetic aperture resolution are studied. Such phase deviations are used to model random motions of target locations and, as expected, it is found that they hinder one's ability to resolve the targets. Graphical plots of some point-target arrangements are presented to illustrate effects of hard limiting and random phase variations. Numerical calculations are used to verify the approximate weak-scatterer theory and to study more general cases such as problems involving more than one strong target which are not readily solved by analytical means. A simple averaging procedure is devised which predicts many aspects of the more accurate numerical results, and the procedure may perhaps be employed in future investigations of mapping continuum scattering surfaces rather than point scatterers. Author (GRA)

N73-32307# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A MECHANICAL ANALOGUE FOR THE STUDY OF HYDROMAGNETIC PROPAGATION IN THE MAGNETOSPHERE
Henry R. Radoski 30 Apr. 1973 17 p refs
(AF Proj. 8601)
(AD-764712; AFCRL-TR-73-0278; AFCRL-AFSIG-265) Avail: NTIS CSCL 04/1

The reduction of the oscillations of the magnetosphere to a simple mechanical analogue, which can be analyzed in detail, is accomplished in three stages: (1) The comparison of the wave equations for a dipole field magnetized plasma to those for a rectangular model of the plasmasphere with a unidirectional field -- the important physical characteristics are shown to be independent of the particular geometry chosen; (2) the comparison of the equations in the above hydromagnetic box with those of a mechanical system consisting of a set of oscillators, representing field lines, coupled by a wave propagating medium -- for the symmetric modes with weak ion-cyclotron coupling, the equations for the hydromagnetic and mechanical systems are essentially identical; (3) the simplification of the mechanical system to an elementary wave-oscillator model representing the coupling between resonant poloidal and toroidal modes -- the nature of the motion of this model is independent of the strength of the coupling. In general, the behavior of coupled and uncoupled modes is essentially different. When any coupling is present, steady state solutions, as normally understood, are not possible. Author (GRA)

N73-32308# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THERMALLY STRATIFIED COMPRESSIBLE FLUID MOTION ON A ROTATING SPHERE WITH GRAVITATION Environmental Research Papers
Edmond M. Dewan 12 Apr. 1973 20 p refs
(AF Proj. 7635)
(AD-764684; AFCRL-TR-73-0225; AFCRL-ERP-442) Avail: NTIS CSCL 04/1

The problem of a thermally stratified compressible fluid on a rotating sphere with gravitation is discussed. An exact solution to the nonlinear Euler equations pertaining to this problem, which was recently obtained by H. E. Moses, is physically explained. The work represents a contribution toward a theoretical understanding of the motions and forces in the atmosphere, the environment in which the Air Force operates. (Modified author abstract) GRA

N73-32309# Army Electronics Command, Fort Monmouth, N.J.
THE POTENTIAL USE OF POLARIZED REFLECTED LIGHT IN THE REMOTE SENSING OF SOIL MOISTURE
Barry Doll Jul. 1973 20 p refs
(DA Proj. 1T0-61102-B-53-A-17)
(AD-765421; ECOM-5501) Avail: NTIS CSCL 08/13

Polarization of light reflected from soil and sand samples is studied as surface moisture and texture of the samples are varied.

A reflectometer equipped with a rotating analyzer records the polarization percentage of the reflected light. The percentage of polarization runs from 15.5% for dry soil to 89% for saturated soil, indicating that the polarization method may be viable as a remote sensing system for determining soil moistures. Background on the methods and implications of the results are presented.
Author (GRA)

N73-32310# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PREDICTING THE DAY-TO-DAY VARIABILITY OF THE MID-LATITUDE IONOSPHERE FOR APPLICATION TO HF PROPAGATION PREDICTIONS
Charles M. Rush and Joseph Gibbs (Arcon Corp., Wakefield, Mass.) 23 May 1973 27 p refs
(AF Proj. 8666)
(AD-764711; AFCRL-TR-73-0335; AFCRL-AFSIG-268) Avail: NTIS CSCL 04/1

Hourly values of ground-based ionosonde data have been subjected to a detailed statistical analysis in order to determine the day-to-day variability displayed by various ionospheric regions. It is found that the standard deviation about the observed F2 region monthly median critical frequency is two to three times that observed in the E and F1 regions at mid-latitudes. The day-to-day variability of foE and foF1 is such that monthly median values of those parameters can be used to represent the daily variation in the E and F1 region. This would imply that HF prediction programs which rely on median data for specification of the ionosphere yield results that can be used in day-to-day operations for those propagation modes that are controlled by the E and F1 region. As the F2 region is highly variable, a method of using timely observations of foF2 to predict the expected values of the F2 region critical frequency has been developed. The method has the advantage that errors in predicting the monthly median foF2 can be averted and the predicted values are generally closer to the actual observations than the observed monthly median. Author (GRA)

N73-32311# Oregon State Univ., Corvallis. School of Oceanography.
MULTISPECTRAL SCANNER STUDIES OF THE OCEAN OFF THE OREGON COAST Final Report
W. Pearcy Jun. 1973 69 p refs
(Contract N62306-70-C-0414)
(AD-763428) Avail: NTIS CSCL 08/10

The objectives of this study were to learn how the radiances of backscattered light of different bandwidths (1) change with distance offshore, (2) correlate with infrared measurements of sea surface temperature, and (3) vary among and within Columbia River plume, upwelled and oceanic waters. In general, color patterns were highly correlated with sea surface temperatures. Nevertheless, some color features were found that indicated more about the age and advection of water than could be inferred from study of temperatures alone. Color variations in the region of the plume were frequently complex and highly structured. Numerous problems developed in the analysis and interpretation of the scanner data that proved difficult to solve and limited the general applicability of the system for quantitative study of ocean color. GRA

N73-32312# Utah State Univ., Logan. Center for Research in Aeronomy.
IONOSPHERIC MODELING Quarterly Technical Report, Jan. - 31 Mar. 1973
L. R. Megill 31 Mar. 1973 10 p refs
(Contract N00014-67-A-0220-0004; ARPA Order 2266)
(AD-764662; QTR-2) Avail: NTIS CSCL 04/1

The previous quarterly report reviewed the computer code that was developed to generate the E and F regions of the polar ionosphere. The results that are given in this report are outputs from that computer program. The philosophy for modeling the very complex D region was explained in the previous quarterly report. A subroutine to calculate the ion-electron pair production due to precipitating protons and alpha particles has been converted from the (PAMATRX) computed program discussed by Adams and Masley (1965). This program is also described in the Ionospheric Modeling Newsletter of May 10, 1973. The technique for calculating the D region ionization due to precipitating electrons is the same as that for the E and F regions described in the last quarterly report. However, the computer subroutine is being modified slightly to be compatible with the proton subroutine in order to conserve computer time. GRA

N73-32313# Texas A&M Univ., College Station. Dept. of Physics.
MONTE CARLO CALCULATIONS OF THE POLARIZATION OF RADIATION IN THE EARTH'S ATMOSPHERE OCEAN SYSTEM
George W. Kattawar, Gilbert N. Plass, and John A. Guinn, Jr. 8 May 1973 65 p refs
(Contract N00014-68-A-0308-0002)
(AD-764622; A/M-Ref-73-6T; Rept-4) Avail: NTIS CSCL 04/1

The degree and direction of polarization, the ellipticity, and the radiance of the radiation at various levels in the atmosphere and ocean are calculated by a Monte Carlo method which includes all orders of multiple scattering. Both Rayleigh scattering by the molecules and Mie scattering by the aerosols as well as molecular and aerosol absorption are included in the model of the atmosphere. Similarly in the ocean both Rayleigh scattering by the water molecules and Mie scattering by the hydrosols as well as absorption by the water molecules and hydrosols are considered. Separate single-scattering phase matrices are calculated from the Mie theory for the aerosols and hydrosols. Both the reflected and refracted rays, as well as the rays that undergo total internal reflection, are followed from the ocean surface. The degree and direction of polarization, the ellipticity, the radiance, and the flux are given as functions of the turbidity of the ocean, the solar zenith angle, and the wavelength of the radiation. Author (GRA)

N73-32314# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
REMOTE SENSING OF MESOSPHERIC OZONE Ph.D. Thesis. Technical Report, Jun. 1969 - Feb. 1971
John E. Rudzki May 1973 207 p refs
(AF Proj. 7660)
(AD-764705; AFAL-TR-73-161) Avail: NTIS CSCL 04/1

Photochemical ozone theory and microwave spectroscopy suggest that microwave radiometry can be used to verify remotely the existence of the mesospheric ozone diurnal variation. A description of the theory and a radiometer built to test the theory is described. Experimental results are given which place an upper limit on the nightime mesospheric ozone concentration of 5 x 10 to the 10th power/cc at 50 km dropping exponentially to 10 to the 9th power/cc at 80 km. Author (GRA)

N73-32315*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
EARTH ALBEDO NEUTRONS FROM 10 TO 100 MeV
Alan M. Preszler 1 Jul. 1973 178 p refs
(Grant NGR-05-008-002; N00014-69-A-0200-5001; N00014-69-A-0200-5004; NR Proj. 387-047)
(NASA-CR-135645; AD-764539; IGPP-UCR-73-37) Avail: NTIS HC $11.00 CSCL 04/1

Neutrons produced by the interaction of primary cosmic rays with atmospheric nuclei have been measured at energies from 10 to 100 MeV and angles from 20 degrees to 80 degrees to the vertical. The data were taken on a balloon flight from Palestine, Texas, 40 degrees North geomagnetic latitude, on September 26, 1971. A telescope constructed of two large area tanks of liquid scintillator measured the incident neutron's energy and direction. Results of calibrations with neutrons of 55 and 15.3 MeV are presented. (Modified author abstract) GRA

N73-32316# Intelcom Rad Tech, San Diego, Calif.
A STUDY OF ION-NEUTRAL REACTIONS OF IMPORTANCE IN THE UPPER ATMOSPHERE Final Technical Summary Report, 1 Aug. 1972 - 30 Apr. 1973
Roy H. Neynaber, John A. Rutherford, and David A. Vroom Jul. 1973 67 p refs
(Contract DNA001-73-C-0031; DNA Proj. NWED-0AXH)
(AD-765333; RT-8086-003; DNA-3134F) Avail: NTIS CSCL 04/1

Reaction cross sections needed for the development of the

ROSC code have been obtained. The major effort has been directed toward obtaining data for the reactions of several atmospheric ions with atomic oxygen. Reaction cross sections have also been obtained for processes involving the metastable N(-)(singlet D) ion. (Modified author abstract) GRA

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-32317* National Aeronautics and Space Administration. Pasadena Office, Calif.
RADIATION AND PARTICLE DETECTOR AND AMPLIFIER Patent
Kenneth C. Schmidt, inventor (to NASA) Issued 11 Sep. 1973 5 p Filed 15 Jul. 1969
(NASA-Case-NPO-12128-1; US-Patent-3,758,781;
US-Patent-Appl-SN-841845; US-Patent-Class-250-207;
US-Patent-Class-250-83.3R; US-Patent-Class-313-104) Avail: US Patent Office CSCL 14B

A radiation or charged particle detector is described which incorporates a channel multiplier structure to amplify the detected rays or particles. The channel multiplier structure has a support multiplying element with a longitudinal slot along one side. The element supports a pair of plates positioned contiguous with the slot. The plates funnel the particles or rays to be detected into the slotted aperture and the element, thus creating an effectively wide aperture detector of the windowless type.
Official Gazette of the U.S. Patent Office

N73-32318* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ROCKET BORNE INSTRUMENT TO MEASURE ELECTRIC FIELDS INSIDE ELECTRIFIED CLOUDS Patent
Lothar Ruhnke, inventor (to NASA) Issued 18 Sep. 1973 5 p Filed 28 Apr. 1972 Supersedes N72-27431 (10 - 18, p 2428)
(NASA-Case-KSC-10730-1; US-Patent-3,760,268;
US-Patent-Appl-SN-248469; US-Patent-Class-324-72) Avail: US Patent Office CSCL 14B

An apparatus for measuring the electric field in the atmosphere which includes a pair of sensors carried on a rocket for sensing the voltages in the atmosphere being measured is described. One of the sensors is an elongated probe with a fine point which causes a corona current to be produced as it passes through the electric field. An electric circuit is coupled between the probe and the other sensor and includes a high ohm resistor which linearizes the relationship between the corona current and the electric field being measured. A relaxation oscillator and transmitter are provided for generating and transmitting an electric signal having a frequency corresponding to the magnitude of the electric field. Official Gazette of the U.S. Patent Office

N73-32319* Technicolor, Inc., Paramus, N.J.
AUTOMATIC LIGHTNING DETECTION AND PHOTOGRAPHIC SYSTEM Patent
Ronald J. Wojtasinski, Larry D. Holley, Jimmie L. Gray, and Robert B. Hoover, inventors (to NASA) Issued 18 Sep. 1972 5 p Filed 27 Sep. 1972 Supersedes N73-10462 (11 - 01, p 0057) Sponsored by NASA
(NASA-Case-KSC-10728-1; US-Patent-3,759,152;
US-Patent-Appl-SN-292682; US-Patent-Class-95-11;
US-Patent-Class-95-11.5) Avail: US Patent Office CSCL 14E

A system is presented for monitoring and recording lightning strokes within a predetermined area with a camera having an electrically operated shutter with means for advancing the film in the camera after activating the shutter. The system includes an antenna for sensing lightning strikes which, in turn, generates a signal that is fed to an electronic circuit which generates signals for operating the shutter of the camera. Circuitry is provided for preventing activation of the shutter as the film in the camera is being advanced.
Official Gazette of the U.S. Patent Office

N73-32320* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STAR TRACKING RETICLES Patent
Wade O. Smith and Albert R. Toft, inventors (to NASA) Issued 18 Sep. 1973 6 p Filed 17 Apr. 1972 Supersedes N73-13419 (11 - 04, p 0419) Continuation-in-part of US Patent Appl. SN-80029, filed 14 Nov. 1972
(NASA-Case-GSC-11188-1; US-Patent-3,759,672;
US-Patent-Appl-SN-244440; US-Patent-Class-29-195Y;
US-Patent-Appl-SN-80029) Avail: US Patent Office CSCL 14B

A method for the production of reticles, particularly those for use in outer space, where the product is a quartz base coated with highly adherent layers of chromium, chromium-silver, and silver vacuum deposited through a mask, and then coated with an electrodeposit of copper from a copper sulfate solution followed by an electrodeposit of black chromium is described. The masks are produced by coating a beryllium-copper alloy substrate with a positive working photoresist, developing the photoresist, according to a pattern to leave a positive mask, plating uncoated areas with gold, removing the photoresist, coating the substrate with a negative working photoresist, developing the negative working photoresist to expose the base metal of the pattern, and chemically etching the unplated side of the pattern to produce the mask.
Official Gazette of the U.S. Patent Office

N73-32321* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOIL PENETROMETER Patent
Earle A. Howard, George M. Hotz, and Robert P. Bryson, inventors (to NASA) Issued 23 Apr. 1968 8 p Filed 20 Sep. 1965 Sponsored by NASA
(NASA-Case-XNP-05530; NASA-Case-XNP-06933;
US-Patent-3,379,052; US-Patent-Appl-SN-488381;
US-Patent-Class-73-81) Avail: US Patent Office CSCL 14B

An auger-type soil penetrometer for burrowing into soil formations is described. The auger, while initially moving along a predetermined path, may deviate from the path when encountering an obstruction in the soil. Alterations and modifications may be made in the structure so that it may be used for other purposes. Official Gazette of the U.S. Patent Office

N73-32322* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPOSURE INTERLOCK FOR OSCILLOSCOPE CAMERAS Patent
Cary R. Spitzer and Jerry D. Stainback, inventors (to NASA) Issued 11 Sep. 1973 5 p Filed 11 Nov. 1971 Supersedes N72-21423 (10 - 12, p 1609)
(NASA-Case-LAR-10319-1; US-Patent-3,757,659;
US-Patent-Appl-SN-197870; US-Patent-Class-95-42;
US-Patent-Class-346-110) Avail: US Patent Office CSCL 14B

An exposure interlock has been developed for oscilloscope cameras which cuts off ambient light from the oscilloscope screen before the shutter of the camera is tripped. A flap is provided which may be selectively positioned to an open position which enables viewing of the oscilloscope screen and a closed position which cuts off the oscilloscope screen from view and simultaneously cuts off ambient light from the oscilloscope screen. A mechanical interlock is provided between the flap to be activated to its closed position before the camera shutter is tripped, thereby preventing overexposure of the film.
Official Gazette of the U.S. Patent Office

N73-32323* Goodyear Aerospace Corp., Akron, Ohio.
COMPRESSION TEST ASSEMBLY Patent
Anthony H. Kariotis, inventor (to NASA) Issued 11 Sep. 1973 4 p Filed 25 Feb. 1972 Supersedes N72-21420 (10 - 12, p 1609) Sponsored by NASA
(NASA-Case-LAR-10440-1; US-Patent-3,757,568;
US-Patent-Appl-SN-229413; US-Patent-Class-73-94;
US-Patent-Class-73-103) Avail: US Patent Office CSCL 14B

A compression test assembly is described which prevents

buckling of small diameter rigid specimens undergoing compression testing and permits attachment of extensometers for strain measurements. The test specimen is automatically aligned and laterally supported when compressive force is applied to the end caps and transmitted to the test specimen during testing.
Official Gazette of the U.S. Patent Office

N73-32324* National Research Corp., Cambridge, Mass.
ULTRAHIGH VACUUM GAUGE HAVING TWO COLLECTOR ELECTRODES Patent
Franklin L. Torney, Jr., inventor (to NASA) Issued 21 Mar. 1967 3 p Filed 21 Mar. 1967 Sponsored by NASA
(NASA-Case-LAR-02743; US-Patent-3,310,699;
US-Patent-Appl-SN-404212; US-Patent-Class-313-7) Avail: US Patent Office CSCL 14B

A gauge for measuring ultrahigh vacuums with great accuracy is described. It provides a means for ionizing the gas whose pressure is being measured, and consists of a collector electrode, a suppressor, radiation shielding, and a second collector. F.O.S.

N73-32325* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QUADRUPOLE MASS FILTER WITH MEANS TO GENERATE A NOISE SPECTRUM EXCLUSIVE OF THE RESONANT FREQUENCY OF THE DESIRED IONS TO DEFLECT STABLE IONS Patent
Robert V. Langmuir, inventor (to NASA) Issued 1 Aug. 1967 4 p Filed 24 Apr. 1964 Sponsored by NASA
(NASA-Case-XNP-04231; US-Patent-3,334,225;
US-Patent-Appl-SN-362261; US-Patent-Class-250-41.9) Avail: US Patent Office CSCL 14B

A mass spectrometer for the separation or separate indication of ions of different specific electric charges is reported. The instrument uses a periodically varying electric field in its analyzing section to excite the injected ions into oscillations while traveling along their trajectories which are either stable or unstable depending on specific parameters. Only stable trajectory ions pass through the electric field to the collector for indication.
G.G.

N73-32326* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOW POWER ELECTROMAGNETIC FLOWMETER PROVIDING ACCURATE ZERO SET Patent
Thomas B. Fryer, inventor (to NASA) Issued 12 Nov. 1971 6 p Filed 12 Nov. 1971 Supersedes N72-22452 (10 - 13, p 1749)
(NASA-Case-ARC-10362-1; US-Patent-3,751,980;
US-Patent-Appl-SN-198289; US-Patent-Class-73-194EM;
US-Patent-Class-128-2.05F) Avail: US Patent Office CSCL 14B

A low power, small size electromagnetic flowmeter system is described which produces a zero output signal for zero flow. The system comprises an air core type electromagnetic flow transducer, a field current supply circuit for the transducer coils and a pre-amplifier and demodulation circuit connected to the output of the transducer. To prevent spurious signals at zero flow, separate, isolated power supplies are provided for the two circuits. The demodulator includes a pair of synchronous rectifiers which are controlled by signals from the field current supply circuit. Pulse transformer connected in front of the synchronous rectifiers provide isolation between the two circuits. Official Gazette of the U.S. Patent Office

N73-32327* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROID DETECTOR Patent
Leonard R. McMaster, Sheldon T. Peterson, and Frank M. Hughes, inventors (to NASA) Issued 9 Oct. 1973 4 p Filed 27 Sep. 1971 Supersedes N72-11371 (10 - 02, p 0198)
(NASA-Case-LAR-10483-1; US-Patent-3,763,691;
US-Patent-Appl-SN-184090; US-Patent-Class-73-12;
US-Patent-Class-73-170R) Avail: US Patent Office CSCL 14B

A meteoroid detector is described which uses, a cold cathode discharge tube with a gas-pressurized cell in space for recording a meteoroid puncture of the cell and for determining the size of the puncture. Official Gazette of the U.S. Patent Office

N73-32328# Joint Publications Research Service, Arlington, Va.
GYROSTABILIZERS
11 Sep. 1973 19 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (USSR), no. 6, 1973 p 81-92
(JPRS-60001) Avail: NTIS HC $3.00

Errors in a uniaxial gyrostabilizer as an angular velocity integrator and combination parametric resonance in gyropendulum installed on moving base are studied. The stability of an indicating gyrostabilizer on rotation of a three stage gyroscope is also investigated. For individual titles, see N73-32329 through N73-32331.

N73-32329 Joint Publications Research Service, Arlington, Va.
ERRORS IN A UNIAXIAL GYROSTABILIZER AS AN ANGULAR VELOCITY INTEGRATOR
Yu. A. Borisov and Yu. V. Levi *In its* Gyrostabilizers (JPRS-60001) 11 Sep. 1973 p 1-7 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (USSR), no. 6, 1973 p 81-86 (For availability see N73-32328 23-14)

Within the framework of precession theory, kinematic errors of a uniaxial gyrostabilizer are studied when measuring the component integral of the absolute angular velocity of the target. The isolation of the basic error component in a quadrature permitting evaluation of the kinematic errors of the uniaxial gyrostabilizer during arbitrary motion of the target is also discussed. Author

N73-32330 Joint Publications Research Service, Arlington, Va.
COMBINATION PARAMETRIC RESONANCE IN A GYROPENDULUM INSTALLED ON A MOVING BASE
Yu. V. Osetinskiy *In its* Gyrostabilizers (JPRS-60001) 11 Sep. 1973 p 8-11 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (USSR), no. 6, 1973 p 87-89 (For availability see N73-32328 23-14)

The stability of the undisturbed motion of the suspension rings of a gyropendulum installed on a moving platform is studied. It is demonstrated that where the frequency of the vertical oscillations of the platform coincides with the sum of the frequencies of the natural oscillations of instrument frames, intense oscillations of the rings of the gimbal occur. Author

N73-32331 Joint Publications Research Service, Arlington, Va.
STABILITY OF AN INDICATING GYROSTABILIZER ON ROTATION OF A THREE-STAGE GYROSCOPE
S. M. Zeldovich and I. M. Okon *In its* Gyrostabilizers (JPRS-60001) 11 Sep. 1973 p 12-16 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (USSR), no. 6, 1973 p 89-92 (For availability see N73-32328 23-14)

Stability condition of an indicating stabilizer in the presence of viscosity in the suspension of a forced rotating three-stage gyroscope is determined. Author

N73-32332# Defence Research Establishment Ottawa (Ontario).
A TRIAL OF INFRARED SENSITIVE TELEVISION EQUIPMENT UNDER WHITEOUT CONDITIONS
R. J. Brown and D. J. DiFruscio Aug. 1973 13 p refs
(DREO-TN-73-11) Avail: NTIS HC $3.00

The feasibility of using a television camera, sensitive in the near infrared portion of the electromagnetic spectrum, to give depth of field perception and horizon detection in a whiteout was investigated, in February 1973. This approach is based on the fact that the reflectivity of snow decreases considerably in this region of the spectrum from the values in the visible region. This decrease may be sufficient to disturb the balance of conditions required to sustain a whiteout. Author

N73-32333*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A LABORATORY SIMULATION OF A SINGLE-AXIS DUAL-LEVEL PRECISION POINTING SYSTEM
Gordon F. Bullock, Frederick R. Morrell, and K. C. Romanczyk Washington Oct. 1973 36 p refs
(NASA-TN-D-7319; L-8943) Avail: NTIS HC $3.00 CSCL 14B

The laboratory simulation of a scaled single-axis dual-level

control system for a large space telescope is demonstrated. The dual-level control system consists of a coarse-body-pointing system and a fine-pointing system, which uses an image motion compensator, an image dissector tube, and digital electronics. The results of the simulation indicate that the dual-level system can be used to provide tracking capability within one-tenth of a diffraction-limited image diameter of a 3-meter f/100 telescope for stars up to a +12.3 visual magnitude. Author

N73-32334*# Barnes Engineering Co., Stamford, Conn.
ACCURATE, RELIABLE PROTOTYPE EARTH HORIZON SENSOR HEAD
Frank Schwarz and Hyman Cohen May 1973 174 p refs
(Contract NAS1-10952)
(NASA-CR-132267) Avail: NTIS HC $10.75 CSCL 14B

The design and performance is described of an accurate and reliable prototype earth sensor head (ARPESH). The ARPESH employs a detection logic 'locator' concept and horizon sensor mechanization which should lead to high accuracy horizon sensing that is minimally degraded by spatial or temporal variations in sensing attitude from a satellite in orbit around the earth at altitudes in the 500 km environ 1,2. An accuracy of horizon location to within 0.7 km has been predicted, independent of meteorological conditions. This corresponds to an error of 0.015 deg-at 500 km altitude. Laboratory evaluation of the sensor indicates that this accuracy is achieved. First, the basic operating prinicples of ARPESH are described; next, detailed design and construction data is presented and then performance of the sensor under laboratory conditions in which the sensor is installed in a simulator that permits it to scan over a blackbody source against background representing the earth space interface for various equivalent plant temperatures. Author

N73-32335*# California Univ., San Diego.
DETECTION AND ESTIMATION OF AN OPTICAL IMAGE BY PHOTON-COUNTING TECHNIQUES Ph.D. Thesis
Lily Lee Wang 1973 218 p refs
(Grant NGL-05-009-079; NSF GK-33811)
(NASA-CR-135498) Avail: NTIS HC $13.00 CSCL 14B

Statistical description of a photoelectric detector is given. The photosensitive surface of the detector is divided into many small areas, and the moment generating function of the photo-counting statistic is derived for large time-bandwidth product. The detection of a specified optical image in the presence of the background light by using the hypothesis test is discussed. The ideal detector based on the likelihood ratio from a set of numbers of photoelectrons ejected from many small areas of the photosensitive surface is studied and compared with the threshold detector and a simple detector which is based on the likelihood ratio by counting the total number of photoelectrons from a finite area of the surface. The intensity of the image is assumed to be Gaussian distributed spatially against the uniformly distributed background light. The numerical approximation by the method of steepest descent is used, and the calculations of the reliabilities for the detectors are carried out by a digital computer. Author

N73-32336*# Arizona Univ., Tucson. Optical Sciences Center.
STUDY OF AN INSTRUMENT FOR SENSING ERRORS IN A TELESCOPE WAVEFRONT Interim Report
L. J. Golden, R. V. Shack, and D. N. Slater Jul. 1973 148 p
(Contract NAS8-27863)
Avail: NTIS HC $9.50 CSCL 14B

Partial results are presented of theoretical and experimental investigations of different focal plane sensor configurations for determining the error in a telescope wavefront. The coarse range sensor and fine range sensors are used in the experimentation. The design of a wavefront error simulator is presented along with the Hartmann test, the shearing polarization interferometer, the Zernike test, and the Zernike polarization test. T.M.R.

N73-32337*# Teledyne Brown Engineering, Huntsville, Ala. Engineering Analysis Dept.
TEST FIXTURE DESIGN FOR BORON-ALUMINUM AND BERYLLIUM TEST PANELS Summary Report
C. G. Breaux Aug. 1973 140 p
(Contract NAS8-29901)
(NASA-CR-124401; ASD-ASTN-1745) Avail: NTIS HC $9.00 CSCL 14B

A detailed description of the test fixture design and the backup analysis of the fixture assembly and its components are presented. The test fixture is required for the separate testing of two boron-aluminum and two beryllium compression panels. This report is presented in conjunction with a complete set of design drawings on the test fixture system. Author

N73-32338*# Montevallo Univ., Ala.
ANALYTICAL STUDY OF THE LARGE ORBITAL X-RAY TELESCOPE IMAGING SYSTEM Final Report
J. William Foreman, Jr. and Joseph M. Cardone Aug. 1973 46 p refs
(Contract NAS8-29855)
(NASA-CR-124429) Avail: NTIS HC $4.50 CSCL 20F

Results of an analytical study of the large orbital X-ray telescope (LOXT) are presented. The LOXT consists of a nested array of four conventional paraboloidal-hyperboloidal X-ray telescopes arranged with a common optical axis and a common focal plane. The composite nested array has a nominal effective focal length of 135.0 inches. The equations of the various mirror surfaces and the numerical values of the parameters in the defining equations are given in the technical specification sheets for the LOXT. Author

N73-32339*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF TECHNIQUES AND ASSOCIATED INSTRUMENTATION FOR HIGH TEMPERATURE EMISSIVITY MEASUREMENTS Final Report
G. R. Cunnington, A. I. Funaa, and P. E. Cassady Jun. 1973 250 p refs
(Contract NAS8-26304)
(NASA-CR-124423; LMSC-D352380) Avail: NTIS HC $14.50 CSCL 14B

Studies were made to develop a test apparatus for the measurement of total emittance of materials under repeated exposure to simulated earth entry conditions. As no existing test facility met the emittance measurement and entry simulation goals, a new apparatus was designed, fabricated and checked out. This apparatus has the capability of performing total and spectral emittance measurements during cyclic temperature and pressure exposure under sonic and supersonic flow conditions. Emittance measurements were performed on a series of oxidized superalloys, silicide coated columbium alloys and ceramic coatings. Author

N73-32340*# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF A ROTATING GRAVITY GRADIOMETER FOR EARTH ORBIT APPLICATIONS (AAFE) Final Report, 22 Jun. 1971 - 21 Sep. 1972
Robert L. Forward, Curtis C. Bell, Philip M. LaHue, Eugene F. Mallove, and David W. Rouse Jan. 1973 297 p refs
(Contract NAS1-10945)
(NASA-CR-112215) Avail: NTIS HC $17.00 CSCL 14B

Some preliminary mission studies are described along with the design, fabrication, and test of a breadboard model of an earth orbital, rotating gravity gradiometer with a design goal of 10 to the minus 11th power/sec sq (0.01 EU) in a 35-sec integration time. The proposed mission uses a Scout vehicle to launch one (or two orthogonally oriented) spin-stabilized satellites into a 330-km circular polar orbit some 20 days before an equinox. During the short orbital lifetime, the experiment would obtain two complete maps of the gravity gradient field with a resolution approaching 270 km (degree 75). The breadboard model of the gradiometer demonstrated a combined thermal and electronic noise threshold of 0.015 EU per data channel. The design changes needed to reduce the noise to less than 0.01 EU were identified. Variations of the sensor output signal with temperature were experimentally determined and a suitable method of temperature compensation was developed and tested. Other possible error sources, such as sensor interaction with satellite dynamics and magnetic fields, were studied analytically and shown to be small. Author

N73-32341*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIRCRAFT WATER VAPOR MEASUREMENTS UTILIZING

AN ALUMINUM OXIDE HYGROMETER
Ernest Hilsenrath Sep. 1973 28 p refs Submitted for publication
(NASA-TM-X-70475; X-651-73-289) Avail: NTIS HC $3.50 CSCL 14B

A hygrometer for water vapor measurements from an aircraft has been developed. An aluminum oxide hygrometer mounted in an aircraft Rosemount air temperature scoop was flown on NASA and USAF aircraft. Water vapor measurements were conducted up to 40,000 feet with penetration into the stratosphere. Good agreement was obtained with simultaneously flown remote sounders of water vapor. During transcontinental flights the hygrometer demonstrated adequate response to measure the natural variability of water vapor near the tropopause. Rapid response was demonstrated in pursuit of the jet wake of an F-104 at 35,000 feet. Author

N73-32342*# Aerojet Electrosystems Co., Azusa, Calif.
ELECTRICALLY SCANNING MICROWAVE RADIOMETER FOR NIMBUS E Final Report
Jan. 1973 50 p
(Contract NAS5-21115)
(NASA-CR-132812; Rept-1740FR-1) Avail: NTIS HC $4.50 CSCL 14B

An electronically scanning microwave radiometer system has been designed, developed, and tested for measurement of meteorological, geomorphological and oceanographic parameters from NASA/GSFC's Nimbus E satellite. The system is a completely integrated radiometer designed to measure the microwave brightness temperature of the earth and its atmosphere at a microwave frequency of 19.35 GHz. Calibration and environmental testing of the system have successfully demonstrated its ability to perform accurate measurements in a satellite environment. The successful launch and data acquisition of the Nimbus 5 (formerly Nimbus E) gives further demonstration to its achievement. Author

N73-32343*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PROTOTYPE PARTIAL ONE-THIRD OCTAVE BAND SPECTRUM ANALYZER FOR ACOUSTIC, VIBRATION AND OTHER WIDEBAND DATA FOR FLIGHT APPLICATIONS
Oct. 1973 92 p
(Contract NAS1-11823)
(NASA-CR-132305) Avail: NTIS HC $6.75 CSCL 14B

The design refinement of a compact frequency analyzer for measurement and analysis on board flight vehicles is discussed. The analyzer has been constructed in a partial one-third octave band configuration with six filters and detectors spaced by the square root of 10 from 316 Hz to 100,000 Hz and a broadband detector channel. The analyzer has been tested over a temperature range of 40 to 120 F at a pressure of one atmosphere, and at a temperature of 75 F at an absolute pressure of 0.000001 torr, and has demonstrated at least 60 db of dynamic range. Author

N73-32344*# McDonnell-Douglas Corp., St. Louis, Mo.
VACUUM LEAK DETECTOR Patent Application
George P. Kazokas, inventor (to NASA) Filed 2 Oct. 1973 10 p
(Contract NAS1-10840)
(NASA-Case-LAR-11237-1; US-Patent-Appl-SN-402868) Avail: NTIS HC $3.00 CSCL 14B

A leak detector is described for use with high vacuum seals as used in feedthroughs and hatch covers for manned spacecraft and vacuum systems. Two thermistors are used, one exposed directly to vacuum and the other exposed to a secondary chamber formed by the seal being monitored and a second auxiliary seal. Leakage into the secondary chamber causes an unbalance of an electrical bridge circuit in which the thermistors are connected. NASA

N73-32345# Joint Publications Research Service, Arlington, Va.
SOME PROBLEMS IN THE DESIGNING OF LARGE MIRROR RADIOTELESCOPES
L. D. Bakhrakh and K. I. Mogilnikova 28 Sep. 1973 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radiofiz. (Moscow), v. 7, no. 4, 1964 p 585-595 (JPRS-60153) Avail: NTIS HC $3.00

Questions concerning the creation of large mirror radiotelescopes are discussed. The requirements for antennas of radiotelescopes in work with low-noise receivers are analyzed. It is shown that ordinary parabolic antennas are not optimal from the point of view of the set requirements. The advisability of using modified two- and three-mirror antennas is shown. Author

N73-32346*# Methodist Hospital, Houston, Tex. Neurophysiology Service.
MODIFICATION OF THE 'FROST ANALYZER' AND IMPROVEMENT OF THE SLEEP-MONITORING CAP Final Report
James D. Frost, Jr. 21 Sep. 1973 41 p refs
(Contract NAS9-12460)
(NASA-CR-134049) Avail: NTIS HC $4.25 CSCL 14B

The recording cap developed for the M133 experiment on Skylab missions was modified to include: (1) two prefilled, sponge-type electrodes (similar to those used for EEG and EOG) were added to chin strap, and (2) the two electrodes previously used for the alternate EEG channel were eliminated, and the C301 EEG preamplifier was utilized for amplification of the EMG signal. When the cap is donned and the chin strap secured, the two EMG electrodes are automatically positioned properly over the submental musculature. The suitability of this data acquisition system, utilizing the chin-electrode placement has been verified in over 100 all-night recording sessions, and the results have been satisfactory both in terms of reliability of the signal and comfort. Author

N73-32347*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A USER'S GUIDE TO THE MARINER 9 TELEVISION REDUCED DATA RECORD
Joel B. Seidman, William B. Green, Paul L. Jepsen, Reuben M. Ruiz, and Thomas E. Thorpe 1 Sep. 1973 69 p refs
(Contract NAS7-100)
(NASA-CR-135712; JPL-TM-33-628) Avail: NTIS HC $5.50 CSCL 14E

The Mariner 9 television experiment used two cameras to photograph Mars from an orbiting spacecraft. For quantitative analysis of the image data transmitted to earth, the pictures were processed by digital computer to remove camera-induced distortions. The removal process was performed by the JPL Image Processing Laboratory (IPL) using calibration data measured during prelaunch testing of the cameras. The Reduced Data Record (RDR) is the set of data which results from the distortion-removal, or decalibration, process. The principal elements of the RDR are numerical data on magnetic tape and photographic data. Numerical data are the result of correcting for geometric and photometric distortions and residual-image effects. Photographic data are reproduced on negative and positive transparency films, strip contact and enlargement prints, and microfiche positive transparency film. The photographic data consist of two versions of each TV frame created by applying two special enhancement processes to the numerical data. Author

N73-32348*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROID IMPACT POSITION LOCATOR AID FOR MANNED SPACE VEHICLES Patent Application
John D. DiBattista, inventor (to NASA) Filed 2 Oct. 1973 10 p
(NASA-Case-Lar-10629-1; US-Patent-Appl-SN-402867) Avail: NTIS HC $3.00 CSCL 14B

Location of meteoroid impacts in space vehicles is found by coating the metallic interior wall of the space vehicle with a thin layer of a coating material having contrasting color to that of the vehicle interior wall. This coating is capable of flaking or chipping off when an impacting meteoroid deforms said wall. Official Gazette of the U.S. Patent Office

N73-32349# Deutsche Forschun-s- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
AN INSTRUMENT FOR AUTOMATIC DETERMINATION OF THE DEGREE OF CLOUD COVERING [GERAET ZUR AUTOMATISCHEN BESTIMMUNG DES WOLKENBEDECK-

UNGSGRADES]
C. Werner, H. A. Mueller, and S. Dietz Bonn Bundeswehramt Feb. 1973 84 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-13) Avail: NTIS HC $6.25; Bundeswehramt 25 DM

A method for the development of a cloud cover indicator system is described. The infrared radiometer pointed directly at a mirror measures the sky radiation based on the difference between cloud and sky thermal radiance. To determine the cloud cover, a threshold value for a clear sky is important. It is shown that the sum of all signal lengths obtained by sky scanning with the radiometer gives the value of the cloud cover. ESRO

N73-32350# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
PROBLEMS INHERENT IN TEST PROGRAM OF A TV TUBE WITH CODER. INFLUENCE ON THE COMPUTERIZED EQUIPMENT [PROBLEMES INHERENTS AU PROGRAMME D'ESSAIS D'UN TUBE TV AVEC CODEUR: INCIDENCE SUR L'EQUIPEMENT INFORMATIQUE]
A. Llebaria 15 May 1972 9 p In FRENCH
(ELEC-011-72) Avail: NTIS HC $3.00

The requirements are discussed in computer storage capability and visual display devices for the FAUST (TV camera tube with signal encoding) test program. The use of the 2114 B computer as a remote terminal to a 12 K words 2100 HP computer is proposed, and budgeting requirements are given. ESRO

N73-32351# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
REPRODUCTION OF SCHMIDT PLATES USING THE JOUAN QUETIN GRATING COPYING TECHNIQUE [COPIE DE LAME DE SCHMIDT PAR LA TECHNIQUE JOUAN QUETIN DE COPIE DE RESEAUX]
26 Jan. 1972 6 p In FRENCH
(OPT-001-72) Avail: NTIS HC $3.00

A Schmidt plate with a deformation of 36 micron between the center and the Kerber zone was replicated for use in reflection mode and tested. Michelson interferometer control of equal thickness fringes demonstrated the reproducibility of the replica to better than one fringe. Defects in the original plate Kerber zone appear inverted on the replica. Photographic results of the test are shown. ESRO

N73-32352# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
USE OF KERBER PROFILE SCHMIDT PLATES IN VARIOUS OPTICAL COMBINATIONS [UTILISATION DE LAMES DE SCHMIDT A PROFIL DE DERBER DANS DIFFERENTES COMBINAISONS OPTIQUES]
Detaille and Saisse 1972 30 p In FRENCH; ENGLISH summary
(OPT-01-72) Avail: NTIS HC $3.50

The advantages of the Schmidt over other telescopes, and those of Schmidt plates with Kerber profiles over other Schmidt plates, are described. A brief account of the methods of making and testing these corrector plates, as well as the manner in which the plates are characterized for purposes of calculation is presented. Some non-classical uses are described; camera focused at finite distance (example, Janus camera). The spherical aberration of these cameras can be corrected by Schmidt plates modified slightly with respect to their classical characteristics; camera with several mirrors, requiring a displacement of the corrector plate with respect to its classical position, examples, S 183 Maurer camera and D2B E.R.C. camera; the spherical aberration and the coma of these cameras can be corrected on condition that the positions of the plate and of the pupil be adequately chosen. Author (ESRO)

N73-32353# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOTOELECTRIC DEVICE FOR THE MEASUREMENT OF SPECTRA AND THE CONCENTRATION OF LIQUID PARTICLES IN AN AEROSOL
L. G. Akulshina, V. N. Arefev, N. K. Nikifirov, and G. I. Shchelchkov 25 Jul. 1973 16 p refs Transl. into ENGLISH from Tr. Inst. Prikl. Geofiz. (Leningrad), no. 7, 1967 p 41-48
(AD-764927; FTD-MT-24-146-73) Avail: NTIS CSCL 04/2

The article describes a photoelectric sensor, based on the well-known Gucker optical circuit, which makes it possible to determine the sizes of liquid aerosol particles in the radius range from 1 to 15 micrometers with concentrations to 1000 1/cc. The AI-100-1 amplitude analyzer is used as the recording device. GRA

N73-32354# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
FLIGHT TESTING OF A CRYOGENICALLY COOLED HYGROMETER
James F. Church and Russell M. Peirce 4 May 1973 30 p refs
(AF Proj. 6670)
(AD-764718; AFCRL-TR-73-0292; AFCRL-IP-188) Avail: NTIS CSCL 04/2

The cryogenically cooled, optical dew/frost point hygrometer was developed to provide a fast response aircraft instrument for the measurement of very low frost-point temperatures encountered at the higher altitudes. A detailed description of the device is presented, along with a discussion of the laboratory and flight tests performed to date. Problems encountered during the tests are outlined, and recommended changes to the instrument are made for the benefit of those contemplating its use in the future. Author (GRA)

N73-32355# Dayton Univ. Research Inst., Ohio.
EVALUATION OF A RADIOGRAPHIC PAPER SYSTEM USING ULTRAVIOLET FLUORESCENT SCREENS. PART 1. PROGRAM OBJECTIVES, TECHNIQUE AND SENSITIVITY DATA FOR F-1 SCREEN Final Technical Report, May 1971 - Feb. 1972
J. A. Holloway and T. R. Henderson Sep. 1972 94 p refs
(Contract F33615-70-C-1337; AF Proj. 7351)
(AD-764779; AFML-TR-72-165-Pt-1) Avail: NTIS CSCL 14/2

Ultraviolet fluorescent screens are being evaluated as part of a radiographic paper system over an X-ray energy range from 25KVCP to 300KVCP in order to determine its potential for replacing X-ray film at a cost savings in certain applications. Part I gives the technique curves obtained for 2024 aluminum from 25KVCP to 150KVCP without screens and with Kodak Industrex Intensifying Screen F-1. Detail sensitivity obtained with penetrameters is reported with this screen for selected thicknesses of aluminum with penetrameters is reported with this screen for selected thicknesses of aluminum over this energy range. A comparison is made of film radiography and paper radiography using two different types of fluorescent screens with titanium and aluminum honeycomb samples. These samples illustrate varying degrees of foam adhesive used to bond the honeycomb to the spar or end closure, water entrapped in the cells, deformed and crushed core. Another application of paper radiography is inspecting wax molds used for making investment cast turbine blades for cracks and porosity. (Modified author abstract) GRA

N73-32356# Harris Electro-Optics Center of Radiation, Ann Arbor, Mich.
PHOTOPLASTIC RECORDING MATERIALS Final Report, 1 May 1972 - 30 Apr. 1973
Willis S. Colburn and Joel B. DuBow Wright-Patterson AFB, Ohio AFAL Aug. 1973 106 p refs
(Contract F33615-72-C-1878; AF Proj. 6096)
(AD-764822; AFAL-TR-73-255) Avail: NTIS CSCL 14/5

The objective of this program was the characterization and development of photoplastic materials for optical memory storage applications. The mechanism of hologram formation in photoplastic materials was studied. Although the technique of corona charging was evaluated, a new technique of parallel-plane charging was developed and found to be preferable to corona charging. A study of the PVK-TNF photoconductor system revealed the mechanism of photoconduction and indicated that the origin of the latent image is immobilized electrons. Techniques were developed to reduce the latent image to reasonable levels. Four thermoplastics were investigated, including an examination of their bandpass nature, the formation of frost, and the heating process. An evaluation was made of the number of record-

erase cycles each material can withstand and causes of degradation were identified. Two materials were capable of over 8000 record-erase cycles. The holographic response of photoplastic materials was characterized through measurements of exposure sensitivity, diffraction efficiency, signal-to-noise ratio, and frequency response. In addition, the holographic response was found to be extremely sensitive to the heat input used to develop the photoplastic hologram. Author (GRA)

N73-32357# Naval Academy, Annapolis, Md. Michelson Physical Lab.
AVRG: A PDP 8/I DATA ACQUISITION AND AVERAGING PROGRAM FOR SYNCHRONOUS HOT WIRE MEASUREMENTS
Samuel A. Elder 31 May 1973 28 p refs
(AD-764851; E-7302) Avail: NTIS CSCL 14/2

The program, in function-modified FOCAL, is specifically designed to enable measurements to be performed on oscillating vertical velocity profiles in the mouth of a flow-excited cavity resonator. Simultaneous hot wire and pressure microphone data samples are recorded at an exact multiple (20X) of the oscillation frequency so as to obtain a synchronous record of the cyclic variation of longitudinal stream velocity at many points in the mouth region. Data is automatically averaged over 100-cycle intervals to remove turbulent background variation. From the stored data, either two or three dimensional velocity profile information can be reconstructed, using sound pressure at the base of the cavity as a phase reference. Options are provided for Fourier analysis, real time (oscilloscope) display, and TTY printout. Author (GRA)

N73-32678 Joint Publications Research Service, Arlington, Va.
OPTICAL ACCUMULATION TIME IN SUPERLONG-BASELINE INTERFEROMETERS
L. R. Kogan *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 39-44 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 707-711 (For availability see N73-32671 23-30)

N73-32703* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
MARINER 9 ULTRAVIOLET SPECTROMETER EXPERIMENT: MARS ATOMIC OXYGEN 1304-ANGSTROM EMISSION
D. J. Strickland, A. Ian Stewart, Charles A. Barth, Charles W. Hord, and Author L. Lane *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 355-368 refs Submitted for publication Sponsored by NASA (For availability see N73-32680 23-30)
CSCL 14B

N73-32704* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
MARINER 9 ULTRAVIOLET SPECTROMETER EXPERIMENT: SEASONAL VARIATION OF OZONE ON MARS
Charles A. Barth, Charles W. Hord, A. Ian Stewart, Arthur L. Lane (JPL), Mary L. Dick, and Gail P. Anderson *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 369-372 refs Submitted for publication Sponsored by NASA (For availability see N73-32680 23-30)
CSCL 14B

N73-32721* Geological Survey, Flagstaff, Ariz.
PHOTOGRAMMETRIC EVALUATION OF MARINER 9 PHOTOGRAPHY
S. S. C. Wu, F. J. Shafer, G. M. Nakata, Raymond Jordan, and K. R. Blasius (Calif. Inst. of Tech., Pasadena) *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 587-592 Submitted for publication (For availability see N73-32680 23-30)
CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-32358* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENHANCED DIFFUSION WELDING Patent
Kenneth H. Holko and Thomas J. Moore, inventors (to NASA) Issued 11 Sep. 1973 4 p Filed 14 Sep. 1972 Supersedes N72-32500 (10-23, p 3099)
(NASA-Case-LEW-11388-1; US-Patent-3,758,741; US-Patent-Appl-SN-289033; US-Patent-Class-219-91; US-Patent-Class-29-497; US-Patent-Class-219-117) Avail: US Patent Office CSCL 13H

Surfaces of unrecrystallized alloys are sanded and polished. This is followed by a two-step welding process by which the strength of the parent metal is retained at the weld joint. The first step forces the surfaces into intimate contact at a temperature where the metal still has good ductility. The second step causes diffusion, recrystallization, and grain growth across the original weld interface. Official Gazette of the U.S. Patent Office

N73-32359* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH SPEED HYBRID BEARING COMPRISING A FLUID BEARING AND A ROLLING BEARING CONVECTED IN SERIES Patent
William J. Anderson, inventor (to NASA) Issued 18 Sep. 1973 2 p Filed 12 Nov. 1971 Supersedes N72-15473 (10 - 06, p 0778)
(NASA-Case-LEW-11152-1; US-Patent-3,759,588; US-Patent-Appl-SN-198379; US-Patent-Class-308-35; US-Patent-Class-308-9) Avail: US Patent Office CSCL 13I

A description is given of an antifriction bearing and a process by which its fatigue life may be extended. The method involves a rotating shaft supported by a fluid bearing and a rolling element bearing coupled in series. Each bearing turns at a fraction of the rotational speed of the shaft. The fluid bearing is preferably conical, thereby providing thrust and radial load support in a single bearing structure.
Official Gazette of the U.S. Patent Office

N73-32360* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PEEN PLATING Patent
Alfred J. Babecki, inventor (to NASA) and Carl L. Haehner Issued 28 Aug. 1973 6 p Filed 6 Dec. 1971 Supersedes N72-20461 (10 - 11, p 1481)
(NASA-Case-GSC-11163-1; US-Patent-3,754,976; US-Patent-Appl-SN-205047; US-Patent-Class-117-105; US-Patent-Class-29-527.2; US-Patent-Class-72-53; US-Patent-Class-117-66; US-Patent-Class-117-105.5; US-Patent-Class-117-130R; US-Patent-Class-117-138.8R; US-Patent-Class-117-151; US-Patent-Class-117-160R) Avail: US Patent Office CSCL 13H

A process for metal plating which comprises spraying a mixture of metallic powder and small peening particles at high velocity against a surface is described. The velocity must be sufficient to impact and bond metallic powder onto the surface. In the case of metal surfaces, the process has as one of its advantages providing mechanical working (hardening) of the surface simultaneously with the metal plating.
Official Gazette of the U.S. Patent Office

N73-32361* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAGNETIC-FLUX PUMP Patent
Alvin F. Hildebrandt, Daniel D. Elleman, and Frank C. Whitmore, inventors (to NASA) Issued 19 Jul. 1966 4 p Filed 29 Nov. 1961 Sponsored by NASA
(NASA-Case-XNP-01188; US-Patent-3,262,025; US-Patent-Appl-SN-155596; US-Patent-Class-317-158) Avail: US Patent Office CSCL 13I

A magnetic flux pump is described for increasing the intensity of a magnetic field by transferring flux from one location to the magnetic field. The device includes a pair of communicating cavities formed in a block of superconducting material, and a piston for displacing the trapped magnetic flux into the secondary cavity producing a field having an intense flux density. F.O.S.

N73-32362* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BURROWING APPARATUS Patent
Ronald F. Scott, Earle A. Howard, and George M. Hotz, inventors (to NASA) Issued 2 Apr. 1968 5 p Filed 13 Sep. 1965 Sponsored by NASA
(NASA-Case-XNP-07169; US-Patent-3,375,885; US-Patent-Appl-SN-486884; US-Patent-Class-175-26) Avail: US Patent Office CSCL 13I

A soil burrowing mole is described in which a housing has an auger blade wound around a front portion. This portion is rotatable about a housing longitudinal axis relative to an externally finned housing rear portion upon operation of driving means to cause an advance through soil and the like. The housing carries a sensor sensitive to deviation from a predetermined path and to which is coupled means for steering the housing to maintain the path. Official Gazette of the U.S. Patent Office

N73-32363 Johns Hopkins Univ., Baltimore, Md.
ULTRASONIC DETECTION OF FATIGUE DAMAGE Ph.D. Thesis
Narayan R. Joshi 1973 221 p
Avail: Univ. Microfilms Order No. 73-16649

Changes in ultrasonic attenuation measurements were used as a continuous monitor of fatigue damage during cyclic testing of polycrystalline aluminum and steel specimens. Ultrasonic pulses were generated by an X-cut quartz transducer firmly attached to the clamped end of a specimen rod using Eastman 910 cement. The frequencies of these ultrasonic pulses were 10 MHz for polycrystalline aluminum and 5 MHz for polycrystalline steel. The specimen shape, transducer size, and frequency used insured that the entire specimen was completely filled with ultrasound in a guided wave mode. The specimen was fatigued as a cantilever beam in reverse bending at 1800 cycles per minute with vertical amplitude peak-to-peak set at a fixed value in the range 7.5 mm to 15 mm. In a typical test the ultrasonic attenuation initially remained constant, changed slowly, and then increased catastrophically just prior to fracture of the test specimen. All experiments performed on both aluminum and steel specimens at various vibrational amplitudes yielded similar results in that ultrasonic attenuation served as a very sensitive indicator of fatigue damage and in every case indicated that failure was eminent several hours before conventional ultrasonic testing could detect an additional echo caused by energy reflected from a crack.
Dissert. Abstr.

N73-32364*# Scientific Translation Service, Santa Barbara, Calif.
STUDY ON THE PERFORMANCE OF BALL BEARINGS AT HIGH dn VALUES
Y. Miyakawa, K. Seki, and M. Yokoyama Washington NASA Sep. 1973 170 p refs Transl. into ENGLISH of "Koh dn Chi Ni Okeru Gyokujikuju No Seino Ni Kansuru Kenkyu", Natl. Aerospace Lab., Tokyo, report NAL-TR-284, May 1972 120 p (Contract NASw-2483)
(NASA-TT-F-15017; NAL-TR-284) Avail: NTIS HC $10.50 CSCL 13I

Experiments conducted to study the limiting speed and bearing performance of deep groove and angular contact ball bearings show that: (1) Limitations in lubrication and strength affect the speed limit of roller bearings; and (2) cage guide type, configuration, and material greatly influence the limiting dn values and the oil flow. G.G.

N73-32365*# Midwest Research Inst., Kansas City, Mo.
LUBRICATION HANDBOOK FOR USE IN THE SPACE INDUSTRY. PART A: SOLID LUBRICANTS. PART B: LIQUID LUBRICANTS
Mahlon E. Campbell and Mason B. Thompson Mar. 1972 310 p
(Contract NAS8-27662; MRI Proj. 3535-E)
(NASA-CR-130490) Avail: NTIS HC $17.50 CSCL 11H

This handbook provides a ready reference for many of the solid and liquid lubricants used in the space industry. Lubricants and lubricant properties are arranged systematically so that designers, engineers, and maintenance personnel in the space industry can conveniently locate data needed for their work. The handbook is divided into two major parts. Part A is a compilation of chemical and physical property data of more than 250 solid lubricants, bonded solid lubricants, dispersions and composites. Part B is a compilation of chemical and physical property data of more than 250 liquid lubricants, greases, oils, compounds and fluids. The listed materials cover a broad spectrum, from manufacturing and ground support to hardware applications for missiles and spacecraft. Author

N73-32366*# TRW Systems Group, Redondo Beach, Calif.
EXTENDED ION PUMPED VACUUM FRICTION TEST Final Report
R. L. Hammel Oct. 1971 146 p refs
(Contract JPL-953123)
(NASA-CR-135480; TRW-20256-6001-R0-00) Avail: NTIS HC $9.50 CSCL 20K

Boundary layer friction data under ion pumped vacuum was taken for sixteen material couples. The test series was an extension of a previous study of the effects of modified ion pumped environments. Sliding distances imposed in the present effort greatly exceeded any studied in the previous contiguous, flight or ground tests. Wear out of specific couples, in particular, thin film lubricants was noted. The behavior of the test hardware including wear out of the mechanisms was noted. As a result, the impact of test interruption was observed for several test couples. Recovery of the friction upon re-establishing sliding in vacuum was generally rapid. The results of the extended sliding study reinforce the previous conclusion that sliding distance (mechanical history) is the primary factor in establishing the force limiting boundary layer friction. General friction value under the extended sliding confirm those observed in previous orbital and the related ground test studies. Author

N73-32367*# General American Transportation Corp., Niles, Ill. Research Div.
VACUUM DISTILLATION/VAPOR FILTRATION WATER RECOVERY, PHASES 1 AND 2 Interim Report
R. J. Honegger, G. A. Remus, and E. K. Krug Jul. 1973 134 p
(GARD Proj. 1528)
(NASA-CR-124397; Contract NAS8-27467) Avail: NTIS HC $8.75 CSCL 13H

The research is reported on the development of an evaporator for vacuum distillation/vapor filtration VD/VF water reclamation system for use on manned space flights. The design, fabrication, and tests of a six-man evaporator are described. It is concluded that: (1) A condenser with an internal rotating impeller and coolant surfaces directly opposite the condensing surfaces is an effective condenser. (2) The VD/VF evaporator, catalyst unit and condenser function satisfactorily based on thermal, mechanical and recovery performance during a 145-hour evaluation test. (3) The quality of recovered water, as measured by analyses for total organic carbon, pH, conductivity, turbidity, and viable bacteria density was within established limits for potability. F.O.S.

N73-32368*# Lockheed Missiles and Space Co., Huntsville, Ala. Fluid Mechanic Applications Group.
RESEARCH STUDY OF MATERIALS PROCESSING IN SPACE EXPERIMENT M512 Phase B Report, 12 month period ending 15 Jul. 1973
M. R. Brashears Aug. 1973 99 p refs
(Contract NAS8-28729)
(NASA-CR-124396; LMSC-HREC-TR-D306700) Avail: NTIS HC $7.00 CSCL 13H

Ground based studies of two proposed experiments which were to be conducted aboard the Skylab Laboratory are reported; metals melting experiment, and sphere forming experiment. These studies were conducted with the objectives of clarifying the effects of gravity and optimizing the experiments within the constraints of existing hardware. All process phenomena were considered, with particular attention given to adhesion-cohesion studies with emphasis on the fluid dynamics of the molten

metal. Detailed thermal histories were generated for three-dimensional specimen geometry including radiation, conduction and vaporization losses with allowances for variable properties. In addition quantitative techniques were used to establish the gravitational level (magnitude and direction) for KC-135 aircraft flights and the actual Skylab mission for both experiments. Author

N73-32369*# Electronic Communications, Inc., St. Petersburg, Fla.
STUDY OF BONDING METHODS OF ALUMINUM BEAM LEADED DEVICES ON MICROCIRCUIT CERAMIC SUBSTRATES Final Report
12 Jul. 1973 56 p
(Contract NAS8-27865)
(NASA-CR-124434) Avail: NTIS HC $5.00 CSCL 13H

The use of aluminum beam lead devices in hybrid circuits is described by modification of existing processing equipment. Principles, procedures, and methods of application of Al beam lead devices are discussed in terms of processing the devices onto hybrids. Author

N73-32370*# Commonwealth Scientific Corp., Alexandria, Va.
DEVELOPMENT OF A METHOD FOR FABRICATING METALLIC MATRIX COMPOSITE SHAPES BY A CONTINUOUS MECHANICAL PROCESS Quarterly Progress Reports, 1 Jan. - 15 Jul. 1973
A. P. Divecha, S. D. Karmarkar, and P. G. Pawar 15 Jul. 1973 41 p
(Contract NAS8-27010)
(NASA-CR-124407; QPR-8/9) Avail: NTIS HC $4.25 CSCL 13H

The continuing efforts in upscaling to produce larger diameter Al/B tubes are described. While the basic methodology remains unchanged, the larger volume of acrylic binder material and its removal by dissolution in toluene had to be performed by dynamic scrubbing. Similarly, the boron and MCF continuous length requirements increased when a 6 foot long by 7 inches wide mat was needed. These modifications and associated problems are described fully with schematics. Also included are seven experiments conducted to prepare larger tubes. The thermal profile, drawing speeds, and furnace positions in the draw bench bay are presented along with metallographic evidence of composite cross sections. Author

N73-32371*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TOTALLY CONFINED EXPLOSIVE WELDING Patent Application
Laurence J. Bement, inventor (to NASA) Filed 10 Sep. 1973 14 p
(NASA-Case-LAR-10941-2; US-Patent-Appl-SN-395493) Avail: NTIS HC $3.00 CSCL 13H

A method is described for eliminating the noise and debris of explosive welding techniques by totally enclosing and applying the explosive pressure through the wall of an enclosure. This method eliminates the problem of scattering debris, and personnel hazards; reduces noise, and retains all the advantages of the conventional explosive welding. F.O.S.

N73-32372*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROPOSED RELIABILITY COST MODEL
Leon M. Delionback 1 Aug. 1973 44 p refs
(NASA-TM-X-64777) Avail: NTIS HC $4.25 CSCL 14D

The research investigations which were involved in the study include: cost analysis/allocation, reliability and product assurance, forecasting methodology, systems analysis, and model-building. This is a classic example of an interdisciplinary problem, since the model-building requirements include the need for understanding and communication between technical disciplines on one hand, and the financial/accounting skill categories on the other. The systems approach is utilized within this context to establish a clearer and more objective relationship between reliability assurance and the subcategories (or subelements) that provide, or reenforce, the reliability assurance for a system. Subcategories are further subdivided as illustrated by a tree diagram. The reliability assurance elements can be seen to be potential alternative strategies, or approaches, depending on the specific goals/objectives of the trade studies. The scope was limited to the establishment of a proposed reliability cost-model format. The model format/approach is dependent upon the use of a series of subsystem-oriented CER's and sometimes possible CTR's, in devising a suitable cost-effective policy. Author

N73-32373# Joint Publications Research Service, Arlington, Va.
CONTROL SYSTEMS
V. N. Zakhorov, D. A. Pospelov, and V. Ye. Khazatskiy 28 Sep. 1973 377 p refs Transl. into ENGLISH from the book "Sistemy Upravleniya" Moscow, Izdatel'stvo Energiya, 1972 344 p
(JPRS-60162) Avail: NTIS HC $21.00

A textbook exposition for engineers for planning control systems for industrial automation is presented. The problems of establishing mutual understanding between the purchaser and the developer, methods of constructing a formalized technical assignment, and evaluations most important to the purchaser are discussed. Author

N73-32374*# Virginia Univ., Charlottesville.
NONLINEAR TRANSIENT ANALYSIS OF MULTI-MASS FLEXIBLE ROTORS - THEORY AND APPLICATIONS
R. Gordon Kirk and Edgar J. Gunter Washington NASA Sep. 1973 265 p refs
(Grant NGL-47-005-050)
(NASA-CR-2300; ME-4040-112-72U) Avail: NTIS HC $6.35 CSCL 13I

The equations of motion necessary to compute the transient response of multi-mass felxible rotors are formulated to include unbalance, rotor acceleration, and flexible damped nonlinear bearing stations. A method of calculating the unbalance response of flexible rotors from a modified Myklestad-Prohl technique is discussed in connection with the method of solution for the transient response. Several special cases of simplified rotor-bearing systems are presented and analyzed for steady-state response, stability, and transient behavior. These simplified rotor models produce extensive design information necessary to insure stable performance to elastic mounted rotor-bearing systems under varying levels and forms of excitation. The nonlinear journal bearing force expressions derived from the short bearing approximation are utilized in the study of the stability and transient response of the floating bush squeeze damper support system. Both rigid and flexible rotor models are studied, and results indicate that the stability of flexible rotors supported by journal bearings can be greatly improved by the use of squeeze damper supports. Results from linearized stability studies of flexible rotors indicate that a tuned support system can greatly improve the performance of the units from the standpoint of unbalanced response and impact loading. Extensive stability and design charts may be readily produced for given rotor specifications by the computer codes presented in this analysis. Author

N73-32375*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BALL MOTION AND SLIDING FRICTION IN AN ARCHED OUTER RACE BALL BEARING
Bernard J. Hamrock [1973] 41 p refs Proposed for submittal to ASME for presentation at the ASME-ASLE Joint Lubrication Conf., Montreal, 8-10 Oct. 1974
(NASA-TM-X-71442; E-7607) Avail: NTIS HC $4.25 CSCL 13I

The motion of the ball and sliding friction in an arched outer race ball bearing under thrust loads is determined. Fatigue life evaluations were made. The analysis is applied to a 150 millimeter bore ball bearing. The results indicated that for high speed-light load applications the arched bearing has significant improvement in fatigue life over that of a conventional bearing. An arching of 0.254 mm (0.01 in.) was found to be an optimal. For an arched bearing it was also found that a considerable amount of spinning occurs at the outer race contacts. Author

N73-32376*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HOLE CUTTER Patent Application
George E. Thornton and Danvis T. Newby, inventors (to NASA)

Filed 19 Sep. 1973 14 p
(NASA-Case-MFS-22649-1; US-Patent-Appl-SN-398901) Avail: NTIS HC $3.00 CSCL 13I

An adjustable hole cutter for use in forming circular openings in workpieces is described. The hole cutter is characterized by a mount of a substantially planar configuration, positionable into a plane paralleling the working plane of a selected workpiece. A shaft for imparting rotary motion to the mount about an axis of rotation normally related to the working plane is included along with a plurality of stabilizing struts for resiliently supporting the mount in parallelism with the working plane as rotary motion. A drill bit is used for drilling a pilot hole concentric with the axis of rotation. NASA

N73-32377# Siemens-Schuckertwerke A.G., Erlangen (West Germany). Abteilung Werkstoffentwicklung.
CERAMIC/METAL BONDS WITH IMPROVED PROPERTIES
Elisabeth Schickfluss-Borges Bonn Bundesmin. fuer Forsch. and Technol. Jun. 1973 84 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-T-73/07) Avail: NTIS HC $6.25; ZLDI, Munich 17,25 DM

Ceramic to metal bonding techniques were investigated. Three aspects were highlighted: the development and testing of adapted test methods, the simplification and improvement of the conventional Mo-Mn-silicate method, and the production of ceramic-metal bonds using interfacially active metals. The test methods include: tensile tests, shear tests, bending tests, density tests, and metallographic tests. During the work on the Mo-Mn method, experiments were carried out to obtain directly weldable layers. Some experiments were carried out with interfacially active metals. ESRO

N73-32378# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
NONDESTRUCTIVE TESTING OF MATERIALS Final Report
11 Sep. 1972 23 p refs
(AD-764200; TOP-3-2-807) Avail: NTIS CSCL 19/6

The report describes standard techniques and facilities for evaluation of surface and subsurface characteristics of metallic and nonmetallic materials. It provides procedures for magnetic particle, liquid penetrant, radiographic, and ultrasonic inspection methods. Appendixes identify current nondestructive test methods and additional ultrasonic test techniques and is applicable to cannon tubes, cast armor plate, welded joints, projectile fuzes, vehicle track shoes, and other material in detection of cracks, voids, corrosion, and thickness variations. Author (GRA)

N73-32379# Defense Documentation Center, Alexandria, Va.
SPUTTERING (INDUSTRIAL PROCESS) Bibliography Mar. 1955 - Nov. 1972
Jul. 1973 217 p refs Revised
(AD-763600; DDC-TAS-73-22-Rev) Avail: NTIS CSCL 13/8

The bibliography contains citations of unclassified and unlimited reports on Sputtering as used in industrial processes dealing with techniques and applications of coatings and films. Discussed are metal films, integrated circuits, thin films, capacitors, resistors and transistors. Author (GRA)

N73-32380# Florida State Univ., Tallahassee. Dept. of Statistics.
PROBABILISTIC MODELS AND STATISTICAL INFERENCE IN RELIABILITY, LIFE TESTING, AND FATIGUE FAILURE Final Scientific Report, 16 Jun. 1971 - 15 Jun. 1973
Frank Proschan Jul. 1973 15 p refs
(Grant AF-AFOSR-2058-71; AF Proj. 9769)
(AD-763818; AFOSR-73-1128TR) Avail: NTIS CSCL 14/4

Research has been completed in the areas of life testing of used and new systems, reliability bounds for various types of systems, Bayesian estimation of reliability, availability theory for multicomponent systems, stochastic comparisons of random processes with applications in reliability, nonstationary shock models, reliability applications of multivariate Schur concave probability densities, parameter estimation of multivariate exponential distributions for various sampling situations, shock models with underlying birth processes, total positivity properties of generating functions, probabilistic models describing component or system wearout, and sensitivity of the Wilcoxon test to dependency between samples. (Modified author abstract) GRA

N73-32381# George Washington Univ., Washington, D.C.
PERFORMANCE EVALUATION OF FOA INTERNAL ENERGY SEPARATORS Final Report, 3 Jan. - 30 Nov. 1972
R. Whitney and S. Smith Dec. 1972 65 p refs Prepared by Columbia Res. Corp.)
(Contract N00019-72-C-0122)
(AD-764585; R-116A) Avail: NTIS CSCL 13/1

The report details the work performed by a contractor to evaluate the actual performance of model energy separators, including a variable geometry device fabricated specifically for this purpose. Tests were conducted on a single rotor energy separator with fixed geometry and a double rotor energy separator with interchangeable collectors and center sections. The latter device is referred to as the variable geometry model. Test results are presented in graphic form and evaluated to reveal preferred Foa energy separators geometry. Fabrication and test procedures are also outlined. GRA

N73-32382# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
NONDESTRUCTIVE TESTING OF PAVEMENTS: FINAL TEST RESULTS AND EVALUATION PROCEDURE Technical Report, Jan. 1971 - Apr. 1972
J. W. Hall, Jr. Kirtland AFB, N. Mex. AFWL Jun. 1973 84 p refs
(Contract F29601-71-X-0004; AF Proj. 683M)
(AD-764787; AFWL-TR-72-151) Avail: NTIS CSCL 13/2

The report presents results for an investigation to develop techniques of nondestructive evaluation of the load-carrying capacity of airfield pavements. Tests were performed with vibratory equipment on pavements where conventional pavement parameters were also measured. Two evaluation approaches, deflection-extrapolation and stiffness methods, are discussed. The nondestructive stiffness method was found to relate to conventional pavement evaluation criteria. Results of the study showed the reliability of the nondestructive pavement evaluation, and a proposed nondestructive evaluation procedure was developed. The equipment used is described in detail, and recommendations are given for improvements to the equipment. Author (GRA)

N73-32383# Boeing Commercial Airplane Co., Seattle, Wash.
APPLICATION OF RELIABILITY ANALYSIS TO AIRCRAFT STRUCTURES SUBJECT TO FATIGUE CRACK GROWTH AND PERIODIC STRUCTURAL INSPECTION Final Report, 16 Jul. 1972 - 31 Mar. 1973
I. C. Whittaker and S. C. Saunders Wright-Patterson AFB, Ohio AFML Jun. 1973 47 p refs
(Contract F33615-71-C-1134; AF Proj. 7351)
(AD-764775; AFML-TR-73-92) Avail: NTIS CSCL 01/3

A method of simulating crack growth has been investigated. The proposed model, which is based on linear elastic fracture mechanics theory, allows for the variability in crack growth behavior found in the experimental data of various materials. Given a reference stress intensity factor range and central tendency values for the crack growth rate and the exponent of the stress intensity factor excursions of a material in a specified configuration, Monte Carlo simulation is used to select various combinations of parameters. These are then used to generate fatigue cracks, on the assumption that crack growth rate is a power function of the stress intensity factor range. The residual strength of the cracked structure is considered to be a decreasing function of the induced crack length. The probability of crack detection also depends on the generated crack and is assumed to improve with increasing crack length. However, this improved detection probability is modified by the probability that the crack location is not the one being inspected. (Modified author abstract) GRA

N73-32384# Illinois Univ., Chicago. Dept. of Materials Engineering.
PRINCIPLES OF INCREMENTAL FORGING: PHASE 3 Final Report, Nov. 1971 - May 1973
T. F. Restivo, A. H. Lonn, and J. A. Schey Jul. 1973 70 p refs
(Contract N00019-72-C-0084)

(AD-764618; Rept-73-4) Avail: NTIS CSCL 13/8

The principles of deformation and of equipment design established in the first two phases formed the basis of development in this third phase of the program. A subpress was designed and built, in which wedge-actuated side rams assured complete synchronization of the vertical (indenting) and horizontal (rib-forming) anvils. .Interconnection of the controls of the hydraulic press with those of an electrically actuated manipulator allowed rapid and precise sequencing of deformation increments. The practicability of the process was demonstrated by hot forging 7075 Al and commercial purity titanium into parts with H-sections of 1/4 in. thick ribs and webs, incorporating stiffening cross-ribs. Lubrication became critical in hot forging; on the basis of solid film durability tests, a commercial resin-bonded graphite film was chosen for lubricating the anvils in forging 7075 Al, and in conjunction with a glass coating applied to the workpiece, also for Ti. (Modified author abstract) GRA

N73-32385# Defense Documentation Center, Alexandria, Va.
LUBRICANTS FOR USE IN THE SPACE ENVIRONMENT Report Bibliography, Nov. 1960 - Sep. 1972
Aug. 1973 143 p refs Supersedes AD-702550
(AD-765300; AD-702550; DDC-TAS-73-53) Avail: NTIS CSCL 11/8

The bibliography is a compilation of references on Lubricants for use in the Space Environment. The selection of a lubricant depends upon the performance requirements of specific applications and upon the environment, i.e., ultrahigh vacuum, high and low temperatures, and zero gravity in which it must function. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included.
Author (GRA)

N73-32386# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE POSSIBILITIES FOR USING RADIANT SOLAR ENERGY FOR WELDING AND SOLDERING OF MATERIALS
I. N. Frantsevich, V. S. Dvernyakov, V. V. Pasichnyi, N. A. Shiganov, and Yu. I. Korunov 26 Jul. 1973 18 p refs Transl. into ENGLISH from an unidentified Russian monograph
(AD-764938; FTD-HT-23-550-73) Avail: NTIS CSCL 13/8

The studies on the application of concentrated solar energy as a source of heat for welding and soldering showed promise in the application of this method both under terrestrial and also under the special conditions of outer space. GRA

N73-32387# Defense Documentation Center, Alexandria, Va.
HIGH TEMPERATURE LUBRICANTS Report Bibliography, Nov. 1960 - Dec. 1972
Jul. 1973 151 p refs
(AD-764700; DDC-TAS-73-49) Avail: NTIS CSCL 11/8

The bibliography is a compilation of references pertaining to High-Temperature Lubricants. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N73-32388# Defense Documentation Center, Alexandria, Va.
MACHINE SHOP PRACTICE Report Bibliography, May 1956 - Dec. 1972
Aug. 1973 162 p refs
(AD-765400; DDC-TAS-73-54) Avail: NTIS CSCL 13/6

The bibliography is a collection of 117 references relating to techniques, procedures, manufacturing methods, time studies and shop layout in machine shop practice. The performance capabilities and effectiveness of machine cutting, drilling, grinding, reaming, forming, spinning and shearing are discussed.
Author (GRA)

N73-32389# CADCOM, Inc., Annapolis, Md.
HIGH PRECISION GEAR INSPECTION AND A COMPUTER SIMULATION OF A MANUFACTURING-INSPECTION PROCESS Final Report, 12 Jun. 1972 - 15 Jan. 1973
Frederick A. Klappenberger 15 Jan. 1973 84 p refs
(Contract N00197-72-C-0610)
(AD-764588; REPT-72-11) Avail: NTIS CSCL 13/9

The report discusses the general approach employed in high precision inspection of external spur gears, likely future trends, and suggests a new non-contact probe centered system be explored based on the experimental results of a prototype demonstration. A computer simulation of the manufacturing/inspection process for an external gear is described, and program listings are provided. A computer program to compute the involute profile is also described and listed. Author (GRA)

N73-32390# Grumman Aerospace Corp., Bethpage, N.Y.
MECHANICAL RELIABILITY PREDICTION PILOT STUDY Final Report
L. Kutin and A. Durner Jun. 1973 157 p refs
(Contract N00600-73-C-0562)
(AD-765367; R/M-73-R-2) Avail: NTIS CSCL 14/4

Grumman Aerospace Corporation performed a pilot study for the Naval Weapons Engineering Support Activity to determine the feasibility of developing mechanical equipment reliability prediction techniques. The results of this study substantiate the feasibility of establishing a standard for mechanical equipment reliability prediction. Continued studies are recommended on additional and varied aircraft mechanical equipment, to expand the scope and data for the eventual development of a mechanical equipment reliability handbook. Author (GRA)

N73-32449 Joint Publications Research Service, Arlington, Va.
HOT PRESSING FEATURES OF MOLYBDENUM CARBIDE
Yu. I. Rogovoy and M. S. Kovalchenko *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 32-36 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 67-73 (For availability see N73-32441 23-18)

N73-32450 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF SILICON CARBIDE PARTS BY HOT CASTING UNDER PRESSURE
G. V. Trunov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 37-41 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 73-78 (For availability see N73-32441 23-18)

N73-32451 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF HIGHLY DISPERSED COPPER BASE POWDER COMPOSITES CONTAINING REFRACTORY METAL CARBIDES
V. I. Motyazhev *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 42-47 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 79-84 (For availability see N73-32441 23-18)

N73-32452 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF YTTRIUM SUBGROUP RARE EARTH METAL DODECABORIDES
V. V. Odintsov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 48-52 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 85-87 (For availability see N73-32441 23-18)

N73-32453 Joint Publications Research Service, Arlington, Va.
SINTERING TITANIUM DIBORIDE-MOLYBDENUM COMPACTS
O. V. Zaverukha *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 53-58 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 93-98 (For availability see N73-32441 23-18)

N73-32454 Joint Publications Research Service, Arlington, Va.
REMOVAL OF THE PLASTICIZER FROM DIE-EXTRUDED HARD-ALLOY PARTS
G. V. Plyushch *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 59-65 Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 104-111 (For availability see N73-32441 23-18)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-32391* National Academy of Sciences - National Research Council, Washington, D.C.
POWER SUPPLY FOR CARBON DIOXIDE LASERS Patent
Gerhard Schiffner, inventor (to NASA) Issued 11 Sep. 1973 6 p Filed 9 May 1972 Supersedes N72-27548 (10-18, p 2443) Sponsored by NASA
(NASA-Case-GSC-11222-1; US-Patent-3,758,877; US-Patent-Appl-SN-251621; US-Patent-Class-331-94.5; US-Patent-Class-307-157; US-Patent-Class-315-101; US-Patent-Class-315-258; US-Patent-Class-315-356; US-Patent-Class-315-DIG.2; US-Patent-Class-330-4.3) Avail: US Patent Office CSCL 20E

An improved ac power supply for a CO2 laser which eliminates the need for ballast resistors to excite a stable discharge is disclosed. The method involves the connection of an inductance in front of the rectifier. This procedure provides a nondissapative positive resistance effect for cancelling the negative differential resistance exhibited by the tube at frequencies below 2 KHz. Such an inductance setup also increases the efficiency of the system. Official Gazette of the U.S. Patent Office

N73-32392 Rochester Univ., N.Y.
LASER PREPULSE VAPORIZATION OF ALUMINUM WIRE TARGETS Ph.D. Thesis
Walter Frank Leising 1973 178 p
Avail: Univ. Microfilms Order No. 73-14822

An experimental and theoretical investigation of the initial interaction of intense laser radiation with a solid target has been conducted in order to determine the effect of a laser prepulse when used to vaporize and ionize a target that is to be heated to thermonuclear temperatures. A theoretical model consisting of initial light absorption, heating of the surface region, vaporization, plasma light absorption, and hydrodynamic expansion is developed. This model is then used as a basis for numerical studies in order to obtain an accurate description of the vaporization rate and the resulting gas and plasma expansion into the surrounding vacuum. The successful combination of theory and experiment indicate that an understanding of the initial interaction of laser radiation whose intensity is in the prepulse regime has been achieved. Dissert. Abstr.

N73-32393 Fordham Univ., New York.
THEORY OF ELECTRON COLLISION EXCITATION OF THE POPULATION INVERSION IN IONIC GAS LASERS Ph.D. Thesis
Charles Bezalel Zarowin 1973 169 p
Avail: Univ. Microfilms Order No. 73-16041

The electron collision excited populations at the singly ionized argon laser, occurring in a low pressure arc, are calculated as a function of the (observable) discharge current density. From these calculated populations, the current density of the optical gain is predicted and found to be in good accord with experiment from a threshold of approximately 50 A/sq cm to over 300 A/sq cm. The electron temperature current density dependence was calculated from kinetic theory while that of the electron density was obtained experimentally. In spite of the experimental agreement of this calculation, it was performed without taking into account the expected strong radiation trapping of the lower laser level by the ionic ground level. With trapping accounted for, the calculation predicts no population inversion in the appropriate range of current densities. This is interpreted as evidence that a nonradiative relaxation mechanism relieves the trapping. Dissert. Abstr.

N73-32394 Illinois Univ., Urbana.
SYNTHETIC HOLOGRAMS AND IMAGE RECONSTRUCTION FROM SUBOPTICAL DIFFRACTION PATTERNS Ph.D. Thesis
Themistocles Haralambos Demetrakopoulos 1973 100 p
Avail: Univ. Microfilms Order No. 73-17524

Some aspects of optical and digital reconstruction techniques as applied to synthetic holograms recorded with suboptical sources are discussed. The objects considered are three dimensional, comprising a sequence of planar distributions located at various depths from the hologram plane. The problem of alleviating the longitudinal distortion that arises in optical reconstruction from suboptical holograms is analyzed. To reduce the longitudinal distortion, the object to be imaged is longitudinally reduced by computer processing during the cource of digitally synthesizing the hologram. The digital approach of resconstruction that entails the application of the inverse diffraction transform to the scattered field of an object illuminated with a suboptical source is described. In this method the reconstructed cross sections of the image are viewed in a sequential number via a CRT display. Dissert. Abstr.

N73-32395# Communications Research Centre, Ottawa (Ontario).
EVALUATION OF A NEW PHOTOPOLYMER HOLOGRAM RECORDING MEDIUM
R. I. MacDonald and K. O. Hill Sep. 1973 14 p refs
(CRC-659) Avail: NTIS HC $3.00

The holographic-recording characteristics of a very sensitive photopolymer are discussed. Upon exposure a latent image forms in the material which is then photically processed to produce a final image in terms of refractive-index variations. The material is thus extremely well suited to the recording of volume phase holograms. The principles of operation of the material and its properties pertaining to holography are reviewed. Experimental data are given which confirm the theoretical prediction that 100 percent diffraction efficiencies can be approached with this type of material. The photopolymer seems well suited to holographic applications where in place development or extremely high diffraction efficiency is required. Author

N73-32396# Defence Research Establishment Valcartier (Quebec).
DYNAMICS OF THE CO2 ATMOSPHERIC PRESSURE LASER WITH TRANSVERSE PULSE EXCITATION
J. Gilbert, J. L. Lachambre, F. Rheault, and R. Fortin Aug. 1973 35 p refs
(DREV-TN-2036/73) Avail: NTIS HC $3.75

The dynamical processes responsible for laser emission in the pulsed pumping of a transversely excited atmospheric (TEA) CO2 laser are investigated. An explanation for the formation of the giant pulse is proposed on the basis of a gain-switching mechanism in which it is assumed that with short strong-current pulses a high population inversion can be achieved prior to the onset of laser action. The kinetics of the mechanism is described by means of set of nonlinear rate equations idealized to a four-energy-state system. With suitable initial conditions on the populations, the transient solution of these equations for the mixtures CO2-He and CO2-N2-He appears to be consistent with the major features of experimental observation. Author

N73-32397# Defence Research Establishment Valcartier (Quebec).
SUPERATMOSPHERIC DOUBLE-DISCHARGE CO2 LASER
M. Blanchard, J. Gilbert, F. Rheault, J. L. Lachambre, and R. Fortin Aug. 1973 13 p refs
(DREV-TN-2092/73) Avail: NTIS HC $3.00

Experimental results on the operation of the operation of a Laflamme doubledischarge laser structure up to pressures of several atmospheres are presented. With an electrical energy input of 30 joules per atmosphere a multimode pulse output of 1 joule is obtained at 6 atmospheres from a 1/3 liter active volume. It is found that a high level of energy deposition into the CO2 gas can be achieved provided the plasma is optimized in both the main discharge and the preionizing discharge. On the basis of the understanding gained during this investigation, a Laflamme structure capable of withstanding prolonged arcing conditions has been developed. Author

N73-32398*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DUALLY MODE LOCKED Nd:YAG LASER Patent Application
John Osmundson (Lockheed Missile and Space Co.), H. Edward Rowe, and Dominick Santarpia, inventors (to NASA) Filed 31 Aug. 1973 18 p

(NASA-Case-GSC-11746-1; US-Patent-Appl-SN-393528) Avail: NTIS HC $3.00 CSCL 20E

A dually mode locked laser system is disclosed. The laser system is of the general type and includes a laser cavity defined by a pair of at least partially reflecting mirrors with a laser material disposed in the cavity. A loss modulator mode locking element and a phase modulator mode locking element are disposed in the laser cavity in optical series with one another. Modulation drive signals are provided for each mode locking element such that each element produces an output pulse train of substantially the same repetition rate and where the output pulse train is in a timed interrelationship such that the pulses pass through both mode locking elements without being extinguished. The loss mode locker is driven at a low level so that relaxation oscillations do not occur and forces the pulses generated by the phase mode locker to maintain a constant phase relative to the mode lock drive signal. The laser system can be run both open loop and with a phase lock stabilization feedback loop. NASA

N73-32399*# Radiation, Inc., Melbourne, Fla. Electro-Optics Operation.

UPDATED OPTICAL READ/WRITE MEMORY SYSTEM COMPONENTS Final Technical Report

Aug. 1973 194 p refs

(Contract NAS8-26672)

(NASA-CR-124442) Avail: NTIS HC $11.75 CSCL 05B

The fabrication of an updated block data composer and holographic storage array for a breadboard holographic read/write memory system is described. System considerations such as transform optics and controlled aberration lens design are described along with the block data composer, photoplastic recording materials, and material development. K.M.M.

N73-32400*# ITT Gilfillan, Inc., Van Nuys, Calif.

STUDY AND DESIGN OF LASER COMMUNICATIONS SYSTEM FOR SPACE SHUTTLE Final Report

21 Sep. 1973 127 p refs

(Contract NAS8-26245)

(NASA-CR-124440; Rept-6906-01012) Avail: NTIS HC $8.50 CSCL 20E

The design, development and operation are described of the laser communications system developed for potential space shuttle application. A brief study was conducted to identify the need, if any, for narrow bandwidth space-to-space communication on the shuttle vehicles. None have been specifically identified that could not be accommodated with existing equipments. The key technical features developed in this hardware are the conically scanned tracker for optimized track while communicating with a single detector, and the utilization of a common optical carrier frequency for both transmission and detection. This latter feature permits a multiple access capability so that several transceivers can communicate with one another. The conically scanned tracker technique allows the received signal energy to be efficiently divided between the tracking and communications functions within a common detector. Author

N73-32401*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

MAP SYNCHRONIZATION IN OPTICAL COMMUNICATION SYSTEMS Interim Technical Report

R. M. Gagliardi and N. Mohanty Apr. 1973 30 p refs

(Grant NGR-05-018-104)

(NASA-CR-132813; USCEE-448) Avail: NTIS HC $3.50 CSCL 20E

The time synchronization problem in an optical communication system is approached as a problem of estimating the arrival time (delay variable) of a known transmitted field. Maximum aposteriori (MAP) estimation procedures are used to generate optimal estimators, with emphasis placed on their interpretation as a practical system device. Estimation variances are used to aid in the design of the transmitter signals for best synchronization. Extension is made to systems that perform separate acquisition and tracking operations during synchronization. The closely allied problem of maintaining timing during pulse position modulation is also considered. The results have obvious application to optical radar and ranging systems, as well as the time synchronization problem. Author

N73-32402*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HOLOGRAPHIC STUDIES OF SHOCK WAVES WITHIN TRANSONIC FAN ROTORS

W. A. Benser, E. E. Bailey, and T. F. Gelder [1973] 30 p refs Proposed for presentation at 19th Intern. Gas Turbine Conf., Zurich, 30 Mar. - 4 Apr. 1974; sponsored by the Am. Soc. of Mech. Engr.

(NASA-TM-X-71430; E-7622) Avail: NTIS HC $3.50 CSCL 20E

Pulsed laser holographic interferometry has been applied to the detection of shock patterns in the outer span regions of high tip speed transonic rotors. The first holographic approach used ruby laser light reflected from a portion of the centerbody just ahead of the rotor. These holograms showed the bow wave patterns upstream of the rotor and the shock patterns just inside the blade row near the tip. Much of the region of interest was in the shadow of the blade leading edge and could not be visualized. The second holographic approach, on a different rotor, used light transmitted diagonally across the inlet annulus past the centerbody. This approach gave a more extensive view of the region bounded by the blade leading and trailing edges, by the part span shroud and by the blade tip. These holograms showed the passage shock emanating from the blade leading edge and a moderately strong conical shock originating at the intersection of the part span shroud leading edge and the blade suction surface. Reasonable details of the shock patterns were obtained from holograms which were made without extensive rig modifications. Author

N73-32403# Defence Research Establishment Valcartier (Quebec).

CHEMICAL LASERS: A COMPREHENSIVE LITERATURE SURVEY

S. J. Arnold and H. Rojeska Aug. 1973 35 p refs

(DREV-TN-2080/73) Avail: NTIS HC $3.75

A bibliography of chemical laser publications covering the period 1964 through 1971 has been compiled. The chronologically listed references are preceded by tables showing the chemical systems exhibiting laser action. An alphabetical author index is also included. Author

N73-32404# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

APPLICATIONS OF PYROELECTRIC DETECTORS TO TELECOMMUNICATION Final Report [APPLICATION DE DETECTEURS PYROELECTRIQUES AU TELECOMMUNICATIONS RAPPORT FINAL]

M. LeGalguen and E. Leiba 27 Apr. 1972 11 p In FRENCH

(Contract DRME-69/34-588)

(LCR-DR-1-72-67/1/R) Avail: NTIS HC $3.00

The attenuation of 10.6 micron carbon dioxide laser radiation, after one km path in the atmosphere, was measured by a pyroelectric detector. The CO2 laser was used at 20 mW power output. The surface of the target at the focus of a 25 cm focal length spherical mirror is one sq mm. Under heavy fog the attenuation rises to over 3000/km whereas rain and haze produce no detectable effect. Observation time was limited to four days. ESRO

N73-32405# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

EXPERIMENTAL INVESTIGATION OF SOME POSSIBLE APPROACHES TO THE X-RAY LASER M.S. Thesis

Kenneth E. Siegenthaler Jun. 1973 110 p refs

(AD-764691; GEP/PH/73-20) Avail: NTIS CSCL 20/5

A discussion of the historical development of the X-ray laser and the problem areas preventing its operation is followed by an experimental investigation of some of the most promising approaches to the X-ray laser. An experiment using 66, 40-nanosecond, Nd:glass laser pulses of over 30 joules was unsuccessful in duplicating the Utah X-ray laser experiment. Data was obtained in the experiment through the use of streak pictures, framing pictures, time exposure pictures, closed-circuit television pictures, burn patterns, X-ray detection by film, pumping laser output and transmission energy measurements, and pulse shape measurements of the pumping laser output, reflection and transmission pulses. An experimental investigation of self-focusing

in glass and liquids as a possible X-ray laser was also conducted. (Modified author abstract) GRA

N73-32406# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF THE RELIABLE GENERATION OF ZERO Pi PULSES WITH A MODE LOCKED CO2 LASER M.S. Thesis.
John E. Dunkle 21 May 1973 117 p refs
(AD-764692; GEP/PH/73-8) Avail: NTIS CSCL 20/5

The report includes a brief summary of the theory of self-induced transparency and detailed information concerning the construction of a CO2 laser and the related equipment that was needed to mode lock the laser. Also, the theory and operation of two room-temperature infrared detectors is provided. The report is concluded with a discussion of the experimental procedures that were involved in the attempt to mode lock the laser and detect the mode locked pulses. GRA

N73-32407# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
BEAM DIVERGENCE: THE MEASUREMENT OF NANO-SECOND LASER PULSES M.S. Thesis.
Douglas E. Caldwell Jun. 1973 100 p refs
(AD-764702; GEP/PH/73-5) Avail: NTIS CSCL 20/5

The divergence of a laser beam is a measure of the rate at which the energy in the beam spreads. There are many ways of measuring the divergence of nanosecond pulses. The data reduction needed to gain accuracies of less than plus or minus 15% involves the expenditure of considerable time. The methods which give results in a short time generally have accuracies of plus or minus 20% or worse. Two of the more accurate methods which are based on photography, the Winer technique and Hartmann method, are compared. Also, a mechanized technique known as SRTLAS, Semi-Real Time Laser Analysis Scanning is discussed. The 40 ns pulses measured during the comparison were produced by a Nd:Glass laser operating at 1.06 micrometer. (Modified author abstract) GRA

N73-32408# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
TUNABLE 10 MICRON LASER, AN INTEGRATED OPTICS APPROACH TO INFRARED GAS LASERS Semiannual Technical Report, 1 Jun. 1972 - 31 Dec. 1973
D. B. Anderson, R. R. August, J. D. McMullen, T. Shubert, R. L. Davis, and L. A. Jenkins 27 Jun. 1973 66 p refs
(Contract N00014-72-C-0505; ARPA Order 1806)
(AD-764638; C72-650.16/501; SATR-2) Avail: NTIS CSCL 20/5

The further development of a tunable CO2 laser employing an integrated optics approach to its construction is discussed. The opposite laser design parameters emphasize application as a local oscillator for a tunable optical heterodyne receiver. The integrated optics approach employs a nonuniform distributed iterative passive waveguide in close proximity to a planar active gas waveguide to form the resonant circuit. Backward wave Bragg diffraction is employed between the active gas and the passive feedback waveguide. Transverse gas flow and transverse excitation are considered as opposed to the longitudinal configuration of a capillary waveguide laser. The incorporation of a traveling surface elastic wave (Rayleigh) collinear and within the passive feedback waveguide to alter the dispersion is the approach considered to achieve the wide unambiguous tuning range. GRA

N73-32409# Calspan Corp., Buffalo, N.Y.
DF-CO2 CHEMICAL TRANSFER LASER DEVELOPMENT Technical Report, Jun. 1971 - Aug. 1972
T. J. Falk Kirkland AFB, N. Mex. AFWL Jun. 1973 95 p refs
(Contract F29601-71-C-0089; AF Proj. 3326; AF Proj. 644A)
(AD-764814; WG-5008-A-1-Vol-1; AFWL-TR-72-169) Avail: NTIS CSCL 20/5

The efficiency of a subsonic transverse flow DF-CO2 chemical transfer laser using helium, nitrogen, and nitrogen-oxygen diluent gases was measured. The spatial variation of small signal gain was also measured for the helium and nitrogen diluent cases. The efficiency of the laser was found to be reduced about 25% by the complete substitution of nitrogen for helium diluent, and for intermediate gas compositions, varied approximately linearly with helium fraction. The maximum small signal gain decreased from 2.5% per cm with helium diluent to 1.2% per cm with nitrogen. Sharing of vibrational energy between the carbon dioxide and nitrogen is believed to be largely responsible for the low gain with nitrogen diluent. The addition of oxygen to the diluent gas strongly degraded laser power and restricted laser operation to low pressures. The effect is believed to result from three-body attachment of fluorine atoms to oxygen molecules. The laser performance was analyzed using steady-state equations for the relaxation processes to provide a basis for extrapolation of laser performance to other configurations. In a brief exploratory series of tests, the laser was operated as a subsonic HF laser without CO2. Dissociating the fluorine with an RF discharge was found to give slightly higher power than did nitric oxide initiation. In both cases the power was much less than that obtained with CO2. Author (GRA)

N73-32410# Lumonics Research Ltd., Ottawa (Ontario).
DEVELOPMENT AND CONSTRUCTION OF A LINE-TUNABLE FUNDAMENTAL-MODE PULSED HF/DF LASER
Dietmar E. Rothe Griffiss AFB, N. Y. RADC Apr. 1973 79 p refs
(Contract F30602-72-C-0394; ARPA Order 1279)
(AD-764709; RADC-TR-73-173) Avail: NTIS CSCL 20/5

The report describes a development program for the construction of a line-tunable single-mode pulsed TE(Transverse Electric discharge) laser, suitable for use with both HF and DF. Experiments performed with a prototype, aimed at suppression of the superradiant background, indicated that it was not possible to lower the optical gain significantly without adversely affecting the tuned pulse energies and the pulse-to-pulse energy reproducibility. The test program and the construction and performance of this laser system are discussed in detail herein. (Modified author abstract) GRA

N73-32411# Massachusetts Inst. of Tech., Cambridge.
ATMOSPHERIC PRESSURE GAS LASERS Semiannual Technical Report, 1 Dec. 1972 - 31 May 1973
Hermann A. Haus 26 Jan. 1973 70 p refs
(Contract DAHC04-72-C-0044; ARPA Order 675)
(Ad-765350) Avail: NTIS CSCL 20/5

The following topics are discussed: Mode locking and pulse selection; Closed-form analysis of electron distribution and pumping rates; In addition, the following preprints are included: Generation and amplification of high-intensity nanosecond tea CO2 laser pulses; Model of mode locking with saturable absorber; Electron distributions in gas lasers. GRA

N73-32412# Xonics, Inc., Van Nuys, Calif.
THEORETICAL STUDIES OF HIGH POWER INFRARED WINDOW MATERIALS Technical Report, 7 Dec. 1972 - 30 Jun. 1973
M. Sparks 30 Jun. 1973 186 p refs
(Contract DAHC15-73-C-0127; ARPA Order 1969)
(AD-765354; TR-1) Avail: NTIS CSCL 20/5

Contents: Theory of infrared absorption and material failure in crystals containing inclusions; Theory of multiphonon absorption in insulating crystals; Temperature dependence of multiphonon infrared absorption; Theory of infrared absorption by crystals in the high frequency wing of their fundamental lattice absorption; Temperature dependence of the absorption coefficient of alkali halides in the multiphonon regime; Temperature and frequency dependence of infrared absorption as a diagnostic tool; Short-pulse operation of infrared windows without thermal defocusing. GRA

N73-32413# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
OXIDE CERAMIC LASER Final Technical Report, 1 Jun. 1970 - 31 May 1973
Charles D. Greskovich 24 Jul. 1973 102 p refs
(Contract N00014-70-C-0360; ARPA Order 1587)
(AD-765345; SRD-73-108) Avail: NTIS CSCL 20/5

Polycrystalline ceramic laser rods, composed of a cubic solid solution of 89 - 94 mole % Y_2O_3, 10 - 5% ThO_2 and 1% Nd_2O_3, were synthesized by a conventional ceramic sintering approach. Rods of this material, called Nd-doped Yttralox (NDY)

ceramic, can be produced with threshold energies lower than that of the best commercially available Nd-glass laser and with a lasing efficiency about 93% that of laser glass at 40J of input energy under pulsed mode conditions. Laser rods can be produced with large variable intermediate-gains by controlled composition; lasing efficiencies depend strongly on cooling rate from the sintering temperature and on the method of powder preparation and processing. Preliminary measurements of laser induced damage in NDY ceramic ,reveals that surface damage precedes bulk damage and that these damage thresholds are presently about 1/4 that of laser glass. Active attenuation coefficients for AR-coated NDY laser rods are given. Careful powder preparation and processing procedures and controlled oxidation of Yttralox ceramic can generate a visible-middle infrared filter or an infrared filter with porosities as low as 10 to the -6th power to 10 to the -7th power. (Modified author abstract)

GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-32414* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NICKEL ALUMINIDE COATED LOW ALLOY STAINLESS STEEL Patent
Salvatore J. Grisaffe and Ernest W. Klechke, inventors (to NASA) Issued 2 Oct. 1973 3 p Filed 18 Oct. 1971 Supersedes N72-15519 (10 - 06, p 0784)
(NASA-Case-LEW-11267-1; US-Patent-3,762,884; US-Patent-Appl-SN-190316; US-Patent-Class-29-196.2; US-Patent-Class-29-196.6; US-Patent-Class-29-197) Avail: US Patent Office CSCL 11F

A coating for low alloy austenitic stainless steel to render the steel highly resistant to oxidation corrosion and erosion from exhaust gases in internal combustion engines is reported.

Official Gazette of the U.S. Patent Office

N73-32415* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COBALT-BASE ALLOY Patent
Robert L. Dreshfield, Gary D. Sandrock, and John C. Freche, inventors (to NASA) Issued 2 Oct. 1973 3 p filed 26 Jan. 1972 Supersedes N72-21538 (10 - 12, p 1625)
(NASA-Case-LEW-10436-1; US-Patent-3,762,918; US-Patent-Appl-SN-221093; US-Patent-Class-73-170; US-Patent-Class-75-171) Avail: US Patent Office CSCL 11F

A microstructurally stable, high strength cobalt based alloy for use at elevated temperatures to 2125 F was developed. The alloys are particularly directed for use in stators and other low stress components in advanced gas turbines.

Official Gazette of the U.S. Patent Office

N73-32416 Connecticut Univ., Storrs.
X-RAY AND ELECTRON MICROSCOPY STUDY OF FATIGUED Cu AND Cu-31 PERCENT Zn Ph.D. Thesis
Choong Man Kim 1973 185 p
Avail: Univ. Microfilms Order No. 73-12037

X-ray line broadening transmission electron microscopy studies of Cu and Cu-31% Zn polycrystalline materials fatigued in plane bending at various load amplitudes are reported. The results of X-ray parameters per cycle are greater for higher amplitude of straining during early stage of fatigue life. The formation of the dislocation cell structure typical of high stacking fault energy materials was observed using the electron microscope in low stacking fault energy material when the specimen was cycled with very high load amplitude. The dislocation density measurements from both X-ray diffraction and electron microscopy technique were in good agreement. Dissert. Abstr.

N73-32417 Illinois Univ., Urbana.
PHASE TRANSFORMATIONS IN METASTABLE BETA PRIME CuZn ALLOYS Ph.D. Thesis
Ivan Cornelis 1973 242 p
Avail: Univ. Microfilms Order No. 73-17520

A comprehensive study of the isothermal beta prime yields alpha sub 1 and athermal martensitic transformations in metastable beta prime CuZn alloys has been performed in order to more clearly delineate the similarities and differences between the two transformations. Microprobe microanalysis of thin foils indicated that the alpha sub 1 plates form without change in composition and that the partitioning of Cu and Zn starts immediately after their formation. The alpha sub 1 and martensitic transformations are basically a b.c.c. yields f.c.c. transition.. However, a different mode of inhomogeneous shear is operative in their formation; the martensite plates are internally twinned, while the alpha sub 1 plates exhibit a regularly divided slip which results in a 3R structure. The lattice orientation relationship between the beta prime matrix and alpha sub 1 and martensite plates respectively was found to be the same. Dissert. Abstr.

N73-32418 Florida Univ., Gainesville.
OPTICAL REFLECTIVITY MEASUREMENTS ON ALLOYS BY COMPOSITIONAL MODULATION Ph.D. Thesis
Juan Alfaro Holbrook 1972 99 p
Avail: Univ. Microfilms Order No. 73-15506

A differential reflectometer, which is capable of measuring small differences in reflectivity between two samples is described. Among the possible applications of this device are: reveal the structure in the spectral relfectivity of metals and alloys, study changes in reflectivity caused by surface reactions and environmental changes, and investigate metallurgical reactions. The instrument was used in the study of compositional modulation of copper based alloys at room temperature in the spectral range between 1.8 and 6.2 eV. For copper-nickel alloys, a decrease in reflectivity in the low energy region was observed with increasing concentrations of nickel. No significant shift of the fundamental edge at 2.1 eV in pure copper was detected when nickel was added to copper in concentrations up to 15 at. % nickel. These observations provide evidence that a virtual-bound-state model applies to these alloys, in agreement with results obtained by photoemission studies. Dissert. Abstr.

N73-32419 Wisconsin Univ., Madison.
FATIQUE BEHAVIOR OF COPPER INCLUDING THE ROLE OF SURFACE LAYERS Ph.D. Thesis
Yoshifumi Nakano 1972 211 p
Avail: Univ. Microfilms Order No. 73-10729

Fatigue behaviors of annealed, oxygen-free, high conductivity copper and the effects of single and periodic intermediate surface layer removal on them were studied by using tests in the high cycle fatigue region. Fatigue tests were conducted in tension-compression under load control. The surface layer removal was performed by electropolishing. The variables of the test conditions were the engineering stress range, the average grain size, and the atmosphere (air and argon gas). Fatigue life and the mechanical properties during fatigue were affected by the test conditions significantly. The difference between the total and the plastic strain ranges was directly related to the fatigue life in all test conditions. The material close to the surface plastically deformed more heavily than the material inside. This surface effect existed only in the shallow surface layer and its depth was less than four times as large as the average grain size. The argon gas atmosphere reduced the macrocrack propagation rate, but did not affect the crack nucleation and microcrack development significantly. Increasing the grain size shortened the crack nucleation and microcrack development stage markedly.

Dissert. Abstr.

N73-32420 Florida Univ., Gainesville.
THE EFFECT OF ELASTIC ANISOTROPY ON DISLOCATION BEHAVIORS IN ORDERED ALLOYS AND INTERMETALLIC COMPOUNDS Ph.D. Thesis
Yuli Lii 1972 130 p
Avail: Univ. Microfilms Order No. 73-15516

The measurement of elastic constants and the use of these measured constants to calculate (1) the interaction force between parallel Shockley partial dislocations and (2) the energy factor of a straight perfect dislocation as a function of dislocation orientation are discussed. While dissociation of a screw dislocation

seems quite normal, the forces between partials in a dissociated edge dislocation are attractive at -196 C and 100 C. In general, the maximum stacking fault energy for which dissociation is energetically favorable, decreases as temperature increases. Inverse Wulff plots indicate that the a/2< 110 total dislocation in Ni3Fe is stable for all orientations and temperatures. Surface slip trace anlaysis together with transmission electron microscope study indicates that the active slip system is of the /111/ < 110 > type. The critical resolved shear stress study shows that 1n (C.R.S.S.) decreases linearly with temperature. Dissert. Abstr.

N73-32421 Maryland Univ., College Park.
TRIBO-ELLIPSOMETRY: A TECHNIQUE FOR THE STUDY OF THE RELATIONSHIP BETWEEN REPASSIVATION KINETICS AND STRESS CORROSION CRACKING SUSCEPTIBILITY Ph.D. Thesis
John Russell Ambrose 1972 135 p
Avail: Univ. Mirofilms Order No. 73-17026

Coupling of tribo-ellipsometry, a technique for measurement of film growth transients following removal of the oxide by abrasion, with conventional electrochemical techniques makes it possible to simulate film rupture and to differentiate between electrochemical metal dissolution and oxide film formation during the subsequent repassivation process. When the experimentally determined variables of total anodic current and film thickness are combined into a total charge/film thickness parameter, this repassivation ratio and its time derivative can be calculated for a metal known to be susceptible to SCC in a particular environment. Dissert. Abstr.

N73-32422 Cornell Univ., Ithaca, N.Y.
FLUCTUATION DIAMAGNETISM OF ALUMINUM AND ALUMINUM ALLOYS ABOVE THE SUPERCONDUCTING TRANSITION TEMPERATURE Ph.D. Thesis
John Howard Claassen 1973 142 p
Avail: Univ. Microfilms Order No. 73-16098

Thermodynamic fluctuations have been shown to produce a small diamagnetic response at temperatures above the superconducting transition temperature. Gollub, Beasley and Tinkham (GBT) have measured this effect for Pb and In, both pure and with impurities. This effect has been measured in both pure Al and Al alloys of solute concentration 0.05 and 0.15 at.% Ag and 0.1, 0.3, 0.5, and 0.8 at.% Si. The apparatus used for these measurements included a SQUID magnetometer in a configuration similar to that of GBT which allowed a resolution in sample magnetization of approximately 2 x 10 to the minus Gauss. The fluctuation magnetization was separated from other contributions by the fact that it is temperature dependent and is completely quenched in sufficiently high fields or temperatures. The apparatus could operate in fields H greater than 100 Oe and allowed the sample temperature to be raised as high as 5 H. Dissert. Abstr.

N73-32423 Missouri Univ., Rolla.
A YIELD AND FRACTURE MODEL FOR Ti-6Al-4V TITANIUM AND 7075-T6 ALUMINUM Ph.D. Thesis
Richard Lee Pendleton 1972 95 p
Avail: Univ. Microfilms Order No. 73-17059

The objective of the research was to conduct a series of experiments on two commonly used structural metals in several different environmental pressures so that a graphical representation of the material response both to yielding and fracture could be ascertained. It was further intended to show that parameters herein defined and called effective stress, effective strain, and pressure are useful parameters for graphically representing the material response. The final goal of this research was to show that the graphical representation does, in fact, predict the yield and fracture for a simple forming process. The forming process, conducted in various environmental pressures, was the folding of a thin plate. Dissert. Abstr.

N73-32424 Case Western Reserve Univ., Cleveland, Ohio.
GROWTH EFFECTS IN THIN NICKEL FILMS Ph.D. Thesis
Robert William Springer 1973 138 p
Avail: Univ. Microfilms Order No. 73-16163

The intrinsic stress of vacuum deposited 2000 Angstrom nickel films was examined and correlation between the microstructure and the measured stress was found. The cantilever plate technique for measuring the stress using a microbalance was analyzed in detail. The bending equations were slightly revised from the former closed form approximations used in the past. Linear bending theory was shown to be adequate for the bending arising from the stressed film. The temperature problems associated with this technique were examined and adverse effects were minimized. No bending due to thermal gradients was observed. Stress from early stages of film growth was recorded. A technique for determining the average grain diameter was developed. Dissert. Abstr.

N73-32425*# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
THE MECHANISM OF GRAIN GROWTH IN CERAMICS
C. M. Kapadia and M. H. Leipold [1972] 52 p refs
(Grant NGL-18-001-042)
(NASA-CR-135673) Avail: NTIS HC $4.75 CSCL 11F

The theory of grain boundary migration as a thermally activated process is reviewed, the basic mechanisms in ceramics being the same as in metals. However, porosity and non-stochiometry in ceramic materials give an added dimension to the theory and make quantitative treatment of real systems rather complex. Grain growth is a result of several simultaneous (and sometimes interacting) processes; these are most easily discussed separately, but the overall rate depends on their interaction. Sufficient insight into the nature of rate controlling diffusion mechanisms is necessary before a qualitative understanding of boundary mobility can be developed. Author

N73-32426*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Minerals Engineering.
CORRELATION OF CREEP RATE WITH MICROSTRUCTURAL CHANGES DURING HIGH TEMPERATURE CREEP Annual Report, 1 Jul. 1972 - 30 Jun. 1973
C. T. Young, W. A. Hochella, and J. L. Lytton Sep. 1973 37 p refs
(Grant NGR-47-004-108)
(NASA-CR-135698) Avail: NTIS HC $4.00 CSCL 11F

The techniques of electron microscopy were used to examine the microstructural changes which occur during primary creep for two important types of engineering alloys: (1) alloys strengthened by solid-solution additions, and (2) dispersion-strengthened alloys. The metals chosen for study are unalloyed titanium, Ti-6Al-4V, and the cobalt-base alloy, Haynes 188. Results to date on NGR 47-004-108 show that development of prior dislocation substructure in Haynes 188 by 10% prestrain and annealing for one hour at 1800 F increases the time to reach 0.5% creep strain at 1600 F by more than an order of magnitude for creep stresses from 3 to 20 ksi. For creep at 1800 F, similar results were obtaind for stresses above 7 ksi, but the prior substructure decreases creep resistance below 7 ksi. This effect appears to be related to instability of grain structure at 1800 F in prestrained material. Author

N73-32427*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS AFFECTING MINIATURE IZOD IMPACT STRENGTH OF TUNGSTEN-FIBER-METAL-MATRIX
Edward A. Winsa and Donald W. Petrasek Washington Oct. 1973 40 p refs
(NASA-TN-D-7393; E-5857) Avail: NTIS HC $3.00 CSCL 11F

The miniature Izod and Charpy impact strengths of copper, copper-nickel, and nickel-base superalloy uniaxially reinforced with continuous tungsten fibers were studied. In most cases, impact strength was increased by increasing fiber or matrix toughness, decreasing fibermatrix reaction, increasing test temperature, hot working, or heat treating. Notch sensitivity was reduced by increasing fiber content or matrix toughness. An equation relating impact strength to fiber and matrix properties and fiber content was developed. Program results imply that tungsten alloy-fiber/superalloy matrix composites can be made with adequate impact resistance for turbine blade or vane applications. Author

N73-32428*# Rocketdyne, Canoga Park, Calif. Advanced Programs.
INFLUENCE OF GASEOUS HYDROGEN ON METALS Final Report
R. J. Walter and W. T. Chandler Oct. 1973 169 p refs

(Contract NAS8-25579)
(NASA-CR-124410) Avail: NTIS HC $10.50 CSCL 11F

Tensile, fracture toughness, threshold stress intensity for sustained-load crack growth, and cyclic and sustained load crack growth rate measurements were performed on a number of alloys in high-pressure hydrogen and helium environments. The results of tensile tests performed in 34.5 MN/m2 (5000 psi) hydrogen indicated that Inconel 625 was considerable embrittled at ambient temperature but was not embrittled at 144 K (-200 F). The tensile properties of AISI 321 stainless steel were slightly reduced at ambient temperature and 144 K (-200 F). The tensile properties of Ti-5Al-2.5 Sn ELI were essentially unaffected by hydrogen at 144 K (-200 F). OFHC copper was not embrittled by hydrogen at ambient temperature or at 144 K (-200 F). Author

N73-32429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL EXPANSION METHOD FOR LINING TANTALUM ALLOY TUBING WITH TUNGSTEN
Gordon K. Watson, John D. Whittenberger, and William F. Mattson Washington Oct. 1973 26 p refs
(NASA-TN-D-7426; E-7402) Avail: NTIS HC $3.00 CSCL 11F

A differential-thermal expansion method was developed to line T-111 (tantalum - 8 percent tungsten - 2 percent hafnium) tubing with a tungsten diffusion barrier as part of a fuel element fabrication study for a space power nuclear reactor concept. This method uses a steel mandrel, which has a larger thermal expansion than T-111, to force the tungsten against the inside of the T-111 tube. Variables investigated include lining temperature, initial assembly gas size, and tube length. Linear integrity increased with increasing lining temperature and decreasing gap size. The method should have more general applicability where cylinders must be lined with a thin layer of a second material. Author

N73-32430*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
CRACK GROWTH BEHAVIOR OF 2219-T87 ALUMINUM ALLOY FROM 20 K (-423 F) TO 422 K (300 F)
W. E. Witzell Aug. 1973 64 p refs
(Contract NAS9-12445)
(NASA-CR-134047; CASD-NAS73-011) Avail: NTIS HC $5.25 CSCL 11F

The aluminum alloy 2219-T87 has great potential for use as a cryogenic material for various manned and unmanned aerospace vehicles. Although its properties are generally known, toughness characteristics in various grain directions when the material is machined from thick plates and subjected to various environments have not been documented. This program, sponsored by the NASA Johnson Space Center, was designed to determine these properties between 20 K (-423 F) and 423 K (300 F). Author

N73-32431*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF FATIGUE AND FRACTURE IN 7075-T6 ALUMINUM ALLOY IN VACUUM AND AIR ENVIRONMENTS
C. Michael Hudson Washington Oct. 1973 38 p refs
(NASA-TN-D-7262; L-8829) Avail: NTIS HC $3.00 CSCL 11F

Axial load fatigue life, fatigue-crack propagation, and fracture toughness experiments were conducted on sheet specimens made of 7075-T6 aluminum alloy. These experiments were conducted at pressures ranging from atmospheric to 5 x 10 to the minus 8th torr. Analysis of the results from the fatigue life experiments indicated that for a given stress level, lower air pressures produced longer fatigue lives. At a pressure of 5 x 10 to the minus 8th torr fatigue lives were 15 or more times as long as at atmospheric pressure. Analysis of the results from the fatigue crack propagation experiments indicated that for small stress intensity factor ranges the fatigue crack propagation rates were up to twice as high at atmospheric pressure as in vacuum. The fracture toughness of 7075-T6 was unaffected by the vacuum environment. Fractographic examination showed that specimens tested in both vacuum and air developed fatigue striations. Considerably more striations developed on specimens tested at atmospheric pressure, however. Author

N73-32432# Institut fuer Elektronen und Ionenforschung, Munich (West Germany).
INFLUENCE OF GAS PARTICLES ADSORBED ON THE SOLID SURFACE AND INFLUENCE OF THE SOLID STATE STRUCTURE ON THE GAS-SOLID-INTERACTION, MEASURED BY MOLECULAR BEAM REFLECTION
Dirk Jaeger 3 Jan. 1973 92 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-14) Avail: NTIS HC $6.75; DFVLR, Porz, West Ger. 27.20 DM

The reflection intensities of a thermal molecular beam (A,Kr) on various solids (Cu,Fe,Ti,Co,Al203) were measured in relation to the incident angle, the solid temperature and the composition of the adsorbable gases. The relation is shown between the intensity distribution of the reflected molecular beam, as a measure for the gas-solid-interaction, and the degree of coverage of the surface with adsorbed gases, the average grain diameter and the plasticity of the solid. The results are compared with experimental and theoretical results of other authors. Author (ESRO)

N73-32433# Naval Research Lab., Washington, D.C.
FATIGUE-CRACK GROWTH OF Ti-6Al-2Cb-1Ta-0.8Mo ALLOY IN AIR AND NATURAL SEA WATER ENVIRONMENTS
W. R. Cares and T. W. Crooker Jul. 1973 15 p refs
(AD-765318; NRL-MR-2617) Avail: NTIS CSCL 11/6

Studies of low-cycle fatigue-crack propagation in air and natural sea water environments were conducted on a Ti-6Al-2Cb-1Ta-0.8Mo alloy. The effects of cathodic polarization of the alloy in sea water were evaluated. The alloy was tested as single-edge-notched, side-grooved samples in zero-to-tension loading and the results were analyzed in terms of crack-tip stress-intensity parameters. The alloy showed no evidence of fatigue sensitivity to either natural sea water or to applied cathodic potential. These results are in agreement with other studies on a similar Ti-6Al-2Cb-1Ta-0.8Mo alloy and a Ti-6Al-4V alloy of similar yield strength and fracture toughness, but are in sharp contrast to the high degree of environmental sensitivity previously exhibited by a Ti-7Al-2Cb-1Ta alloy. Author (GRA)

N73-32434# Franklin Inst. Research Labs., Philadelphia, Pa.
DEVELOP ULTRAFINE GRAIN SIZE TITANIUM WITH IMPROVED MECHANICAL PROPERTIES Final Report
Roger C. May Apr. 1973 71 p refs
(Contract N00019-72-C-0253)
(AD-765329; FIRL-F-C3277) Avail: NTIS CSCL 11/6

Modified Kahn-type tear tests and fatigue crack propagation tests were conducted to evaluate the effect of strengthening by grain refinement and/or cold deformation on the toughness of alpha titanium. In addition to grain size and cold work, the effects of interstitial content, texture, and substitutional alloying were evaluated. For unalloyed materials, the tear strength and the fatigue crack propagation rates were generally improved with increasing yield strength, independently of the chemical and structural conditions. Ti-6Al-4V and Ti-5Al-2.5Sn alloys showed reduced tear strengths. Measurement of the unit propagation energy during tear testing was found to be very sensitive to differences in chemistry and structure. (Modified author abstract) GRA

N73-32435# National Materials Advisory Board, Washington, D.C.
DIRECTIONALLY SOLIDIFIED COMPOSITES: KNOWN ALSO AS IN SITU COMPOSITES, OR DIRECTIONALLY SOLIDIFIED EUTECTICS Final Report
Apr. 1973 115 p refs
(Contract DA-49-083-OSA-3131)
(AD-765348; NMAB-301) Avail: NTIS CSCL 11/6

The formation of an in situ composite by means of appropriate directional solidification is a process with great potential for high-strength, high-temperature materials. An obvious primary application is for gas turbine blades, but non-structural applications also are possible and at least one of these is already a commercial product. The report, the results of a study by the ad hoc Committee

on Directional Solidification of the National Materials Advisory Board, focuses on the potential of this new class of material, the problems to be faced in designing equipment using it, and the steps that should be taken to advance the science and technology of directionally solidified composited. (Modified author abstract) GRA

N73-32436# Ohio State Univ. Research Foundation Columbus.
HIGH-TEMPERATURE ELECTROCHEMICAL RESEARCH IN METALLURGY Final Report, 1 Oct. 1969 - 30 Sep. 1972
W. M. Boorstein, R. A. Rapp, and G. R. St.Pierre Apr. 1973 201 p refs
(Contract F33615-70-C-1103; AF Proj. A01466)
(AD-764769; AFML-TR-73-67) Avail: NTIS CSCL 11/6

Various types of novel high-temperature electrochemical devices incorporating solid, oxygen ion-conducting electrolytes were designed, analyzed, and tested for potential application in research and industrial metallurgical processing. Devices for measurement and/or control of the thermodynamic activity of oxygen (and related non-metallic components) in stagnant or flowing gases and in solid and liquid metals; for the continuous coulometric deoxidation of molten metal streams; for the measurement of thermodynamic and kinetic parameters of metallurgical reactions; and for the determination of sulphur contents in molten alloys and slags were specifically investigated. Scientific data were obtained on the electrical conductivity characteristics of commercial solid oxide electrolyte materials (including local cell effect); on the fundamental principles of operation of solid-electrolyte electrochemical cells as oxygen pumps; and on the diffusivity and solubility of oxygen in molten copper, silver, lead, and iron. (Modified author abstract) GRA

N73-32442 Joint Publications Research Service, Arlington, Va.
EMISSITIVITY OF ZIRCONIUM AND NIOBIUM CARBIDES IN THE REGION OF HOMOGENEITY
L. N. Okhremchuk and G. Sh. Upadkhaya *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 1-3 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykh Materialov" Kiev, 1972 p 7-9 (For availability see N73-32441 23-18)

N73-32448 Joint Publications Research Service, Arlington, Va.
STUDY OF SINTERING KINETICS BY HOT EXTRUSION OF ZIRCONIUM AND TITANIUM CARBIDES IN THE REGIONS OF THEIR HOMOGENEITY
V. Ya. Naumenko and R. Ya. Petrykina *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 25-31 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 60-67 (For availability see N73-32441 23-18)

N73-32456 Joint Publications Research Service, Arlington, Va.
EFFECT OF ALLOYING ELEMENTS ON SHIFT OF THE ALPHA-BETA-TRANSFORMATION IN TITANIUM AND ZIRCONIUM
S. M. Braun *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 71-74 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 141-144 (For availability see N73-32441 23-18)

N73-32457 Joint Publications Research Service, Arlington, Va.
STUDY OF SOME PROPERTIES OF ZIRCONIUM WITH ADDITIONS OF TRANSITION METALS
V. F. Filippov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 75-83 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 144-153 (For availability see N73-32441 23-18)

N73-32458 Joint Publications Research Service, Arlington, Va.
RARE-EARTH METAL MODIFICATION OF TITANIUM
V. A. Kashchuk and A. I. Cherkashin *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 84-87 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 154-158 (For availability see N73-32441 23-18)

N73-32461 Joint Publications Research Service, Arlington, Va.
INTERACTION OF TRANSITION METAL CARBIDES WITH SILICON
E. V. Kutysheva *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 100-105 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 204-210 (For availability see N73-32441 23-18)

N73-32462 Joint Publications Research Service, Arlington, Va.
FRACTIONATION OF FINE METALLIC POWDERS
A. F. Shapoval *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 106-109 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 217-221 (For availability see N73-32441 23-18)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-32437* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYNTHESIS OF SUPERCONDUCTING COMPOUNDS BY EXPLOSIVE COMPACTION OF POWDERS Patent
Upendra Roy, Guenther H. Otto, and Orvil Y. Reece, inventors (to NASA) Issued 14 Aug. 1973 3 p Filed 8 Jul. 1971 Supersedes N71-34500 (09 - 21, p 3442)
(NASA-Case-MFS-20861-1; US-Patent-3,752,665; US-Patent-Appl-SN-160860; US-Patent-Class-75-135) Avail: US Patent Office CSCL 11D

Superconducting intermetallic compounds such as Nb3Sn are prepared by disposing a finely divided, stoichiometric mixture of elemental metal powders in a container, surrounding the container with an explosive, and detonating the explosive. The resulting explosive shock wave provides the necessary reduction conditions for compund formation.
Official Gazette of the U.S. Patent Office

N73-32438 California Univ., San Diego.
A CONTINUUM THEORY WITH MICROSTRUCTURE FOR WAVE PROPAGATION IN COMPOSITE MATERIALS Ph.D. Thesis
Thomas Carter Bache, Jr. 1973 207 p
Avail: Univ. Microfilms Order No. 73-16597

The model addressed is that of a laminated composite constructed of alternating layers of two different materials with perfect interface bands. Using this elementary model, which is both instructive and of practical interest, details of the derivation are not obscured by geometric complexity. Several typical problems, involving a variety of kinematic and constitutive assumptions, are posed and the continuum theory for each is discussed. The technique employed for deriving continuum theories for laminated composite material problems is also useful for obtaining consistent approximate theories for other problems in mechanics. To demonstrate this point, the technique is applied to the problem of vibrations of an elastic plate. A simple and straightforward definition of a hierarchy of approximate theories of increasing orders of accuracy is given for both extensional and flexural wave problems. Comparison to some existing approximate theories is included. Dissert. Abstr.

N73-32439 California Univ., Davis.
SHEAR WAVES IN LAYERED COMPOSITES Ph.D. Thesis
Clarence William Robinson, Jr. 1972 106 p
Avail: Univ. Microfilms Order No. 73-16930

Beginning from the theory of elasticity, the propagation of shear waves is analyzed in a layered composite. The analogy between such a composite and a crystal lattice is developed, allowing interpretation of the problem in terms of lattice theory and allowing adoption of may concepts and results from solid state physics. Methods for the solution of boundary value problems

are derived, and a computer program to evaluate the functions and provide graphical representations of the solutions is described. Interferometric ultrasonic experiments were performed on a layered steel/copper composite. For waves propagating normal to the layers, the existence of allowed propagation frequencies (bands) and forbidden frequencies (gaps) was observed for three bands and two gaps. For waves propagating obliquely the existence of diffracted waves was observed. The resulting experimental dispersion relations fit the theory to a high degree of precision. Dissert. Abstr.

N73-32440 Maryland Univ., College Park.
A STUDY OF THE OPTICAL AND ELECTRICAL PROPERTIES OF AMORPHOUS Si AND THEIR DEPENDENCE UPON THERMAL HISTORY Ph.D. Thesis
Adam James Lewis, Jr. 1972 150 p
Avail: Univ. Microfilms Order No. 73-17040

The results are presented of optical and electrical measurements on a series of vacuum evaporated amorphous Si films. These films were subsequently annealed in vacuum and the properties remeasured. It was found that the optical and electrical properties were a strong function of annealing temperature up to about 400 C. Above 600 C the films crystallized. For T < 400 C measurements are interpreted with a model based on the known properties of surface states on cleaved Si crystals. Evidence for this model in the photoemission, photoconductivity, and optical absorption work of others will be presented. It is believed that the transport properties measured in these films is due to an extrinsic-like process that is not a consequence of the lack of long range order. For T < 400 C is believed that the most coherent description of the optical and electrical conductivity can be given by models based on disorder already found in the literature. Dissert. Abstr.

N73-32441# Joint Publications Research Service, Arlington, Va.
TECHNOLOGY OF PRODUCING NEW MATERIALS
23 Aug. 1973 113 p refs Transl. into ENGLISH of the publ. "Tekhnologiya Polucheniya Novykh Materialov" Kiev, 1972 (JPRS-59873) Avail: NTIS HC $7.75

The physical, mechanical, and electrical properties of various types of composite materials are discussed. Hot extrusion, hot pressing, and sintering processes for producing the composite materials are described. Some of the composite materials considered include the following: (1) silicon carbide, (2) rare earth metal dodecaborides, (3) titanium compounds, (4) zirconium compounds, (5) ceramics, and (6) reinforced plastics. For individual titles, see N73-32442 through N73-32462.

N73-32442 Joint Publications Research Service, Arlington, Va.
EMISSITIVITY OF ZIRCONIUM AND NIOBIUM CARBIDES IN THE REGION OF HOMOGENITY **c17**
L. N. Okhremchuk and G. Sh. Upadkhaya *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 1-3 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykh Materialov" Kiev, 1972 p 7-9 (For availability see N73-32441 23-18)

The temperature relationship of monochromatic coefficients of radiation of titanium, niobium, and zirconium monocarbides in the regions of their homogeneity was investigated. Measurements were made on compact samples in the 1,000 to 1,800 C interval using a model of an absolute black body. The preparation and characteristics of the test samples are described. It was determined that the radiation coefficient of all the studied monocarbides increases somewhat with increased content of bonded carbon. Author

N73-32443 Joint Publications Research Service, Arlington, Va.
WORK FUNCTION OF SILICON CARBIDE
L. N. Okhremchuk *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 4-7 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 10-14 (For availability see N73-32441 23-18)

The temperature relationship of the work function of silicon carbide was investigated. Silicon carbide was considered to be a material with good prospects for use in devices which directly convert thermal energy into electrical energy. The physical and chemical properties of silicon carbide are discussed with emphasis on the emission properties. Measurement of the work function was performed on nonporous polycrystalline samples by thermoemission and contact variance of potentials. The preparation and characteristics of the samples are described. Author

N73-32444 Joint Publications Research Service, Arlington, Va.
ELECTRICAL RESISTANCE OF COMPOSITE MATERIALS
Ye. M. Petrova *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 8-13 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 24-30 (For availability see N73-32441 23-18)

The electrical resistance of a metal-carbide two-phase system was investigated. Carbide powders were used as the initial materials. The chemical and granulometric compositions and properties of the metal carbides are presented. The process for preparing the samples is described. Charts are developed to show the relationship between specific electrical resistance and porosity. Author

N73-32445 Joint Publications Research Service, Arlington, Va.
HEAT CAPACITY MEASUREMENT IN SOME CERAMIC MATERIALS
D. M. Karpinos and V. S. Klimenko *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 14-17 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 38-42 (For availability see N73-32441 23-18)

A method for determining the heat capacity of ceramic materials is discussed. The process is referred to as the condensate weight method. The sample of the material is placed in an atmosphere of saturated vapor above the surface and boiling at atmospheric pressure. Some quantity of heat is transferred to the sample by means of vapor condensation on its surface as a result of which the sample is heated to the boiling point of the liquid. The process of condensation can be stopped and the amount of condensate on the sample as a result of dynamic equilibrium remains constant. The average specific heat capacity of the sample is determined by the amount of heat transferred to the sample which is equal to the product of the condensate weight multiplied by the specific heat of condensation and the weight of the sample multipled by the temperature difference. Author

N73-32446 Joint Publications Research Service, Arlington, Va.
THERMAL CONDUCTIVITY OF REINFORCED PLASTICS
D. M. Karpinos and V. S. Klimenko *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 18-20 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 48-51 (For availability see N73-32441 23-18)

The thermodynamical properties of synthetic resin-base materials with fillers are discussed. Data are presented on the increase in thermal conductivity of metal-filled plastics. It is stated that analytical determination of the thermal conductivity of heterogeneous materials encounters serious difficulties associated with the fact that numerous factors influence the properties being studied and the calculation formulas were derived for the non-ideal models and were not always correct. Author

N73-32447 Joint Publications Research Service, Arlington, Va.
ONE OPTIMUM CASE OF A METHOD OF AXIAL THERMAL FLOW FOR DETERMINING THE COEFFICIENT OF THERMAL CONDUCTIVITY **c33**
V. S. Klimenko, O. A. Dobrovolskiy, and I. K. Senchenkov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 21-24 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 51-58 (For availability see N73-32441 23-18)

In measurements of the coefficient of thermal conductivity by methods using conditions of a uniform thermal flux, the main difficulty, especially in conditions of wide temperature measurements, is removal or consideration of the heat transfer from the sample side surface with the surrounding medium. By analysis of the temperature fields and local thermal fluxes during heat exchange of the rod with a cylindrical thermostat as natural convection, radiation and through the thermal insulation it was possible to determine the optimum conditions of conducting the

experiment, providing minimum level of heat exchange of the sample with the surrounding medium for a given temperature drop along the sample length and to find an adequately simple and constructive solution. Author

N73-32448 Joint Publications Research Service, Arlington, Va.
STUDY OF SINTERING KINETICS BY HOT EXTRUSION OF ZIRCONIUM AND TITANIUM CARBIDES IN THE REGIONS OF THEIR HOMOGENEITY **c17**
V. Ya. Naumenko and R. Ya. Petrykina *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 25-31 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 60-67 (For availability see N73-32441 23-18)

The sintering kinetics of transition metal carbides with different diffusion mobility, viscosity, and degree of compaction were investigated. The kinetics of sintering by hot extrusion of zirconium and titanium carbides was investigated in the region of homogeneity. Viscous flow of the porous solid was also studied and values of the activation energy in the initial stage of the sintering process were calculated in relation to the carbon content in the carbide. The process for preparing the samples and conducting the investigation are described. Author

N73-32449 Joint Publications Research Service, Arlington, Va.
HOT PRESSING FEATURES OF MOLYBDENUM CARBIDE **c15**
Yu. I. Rogovoy and M. S. Kovalchenko *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 32-36 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 67-73 (For availability see N73-32441 23-18)

The formulated structure of molybdenum carbide samples during hot pressing was investigated. Procedures for preparing the samples and conducting the investigation are discussed. Charts are presented to show the relation between the change in microhardness along the cross section of hot pressed molybdenum carbide and distance from the surface in millimeters. A line intensity diagram for molybdenum carbide for the initial powder, center part of a hot pressed sample, outer layer of the hot pressed sample, and the relative intensity is included. Author

N73-32450 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF SILICON CARBIDE PARTS BY HOT CASTING UNDER PRESSURE **c15**
G. V. Trunov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 37-41 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 73-78 (For availability see N73-32441 23-18)

The characteristics of silicon carbide samples produced by hot casting under pressure are discussed. The method for preparing the samples is described. Data are presented in the form of graphs to show: (1) the effect of aliphatic acids on the dross viscosity, (2) the effect of binder content on viscosity, and the relationship of silicon carbide dross viscosity to powder fraction. Author

N73-32451 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF HIGHLY DISPERSED COPPER BASE POWDER COMPOSITES CONTAINING REFRACTORY METAL CARBIDES **c15**
V. I. Motyazhev *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 42-47 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 79-84 (For availability see N73-32441 23-18)

An investigation was conducted into the possibility and conditions of producing highly dispersed composite powders on a copper base containing carbides of titanium, zirconium, niobium, chromium, molybdenum, and tungsten by reducing the main copper carbonate with hydrogen at 80 to 400 C. The methods for preparing the samples and conducting the tests are described. The initial powder characteristics of the carbides are presented. The relationship between the reaction completeness coefficient and reduction temperature is established. Author

N73-32452 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF YTTRIUM SUBGROUP RARE EARTH METAL DODECABORIDES **c15**
V. V. Odintsov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 48-52 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 85-87 (For availability see N73-32441 23-18)

Methods for producing yttrium subgroup rare earth metal dodecaborides are discussed. The characteristics of various types of dodecaborides are tabulated. It is concluded that the boro-thermal reduction of rare earth metal oxides makes it possible to produce adequately pure dodecaborides. Author

N73-32453 Joint Publications Research Service, Arlington, Va.
SINTERING TITANIUM DIBORIDE-MOLYBDENUM COMPACTS **c15**
O. V. Zaverukha *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 53-58 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 93-98 (For availability see N73-32441 23-18)

The process for sintering titanium diboride-molybdenum compacts and the resulting characteristics are discussed. The method of preparing the samples of molybdenum is described. Graphs are presented to show the temperature-time relationship with respect to compact resistivity, porosity, and shrinkage are provided. It is concluded that it is possible to produce parts from titanium diboride and molybdenum with a porosity less than ten percent under conditions of high temperature sintering. Author

N73-32454 Joint Publications Research Service, Arlington, Va.
REMOVAL OF THE PLASTICIZER FROM DIE-EXTRUDED HARD-ALLOY PARTS **c15**
G. V. Plyushch *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 59-65 Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 104-111 (For availability see N73-32441 23-18)

Plasticizer is added for accomplishment of hard-alloy powder extrusion and must be removed during low-temperature sintering of the extruded blanks. Upon heating the plasticizer is removed in the liquid state, burning out or vaporized, which is accompanied by volumetric changes: blank expansion caused by thermal expansion of the hard-alloy mixture and increased sample volume during plasticizer melting and in conversion from the liquid to gaseous state. In the volume of the blank, in relation to its dimensions and rate of increasing temperature, these phenomena can occur simultaneously and at a different rate in different elements of the volume. The process of plasticizer removal is determined by the change in temperature with time. Author

N73-32455 Joint Publications Research Service, Arlington, Va.
STUDY OF SOLID-PHASE INTERACTION OF MOLYBDENUM AND TUNGSTEN DISILICIDES WITH Ti AND Zr IN AN ELECTRON-BEAM HEATER
O. S. Yurchenko *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 66-70 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 129-134 (For availability see N73-32441 23-18)

The problem of solid-phase interaction of refractory metals and refractory compounds at high temperatures was investigated. Emphasis is placed on the interaction of molybdenum and tungsten disilicides with titanium and zirconium in an electron beam heater. The method of high temperature heating of refractory materials with an electron beam makes it possible to heat material pairs over a broad temperature interval. This method provides satisfactory repeatability and eliminates the effect of heater material. Author

N73-32456 Joint Publications Research Service, Arlington, Va.
EFFECT OF ALLOYING ELEMENTS ON SHIFT OF THE ALPHA-BETA-TRANSFORMATION IN TITANIUM AND ZIRCONIUM **c17**
S. M. Braun *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 71-74 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov"

Kiev, 1972 p 141-144 (For availability see N73-32441 23-18)

An investigation was conducted of the alpha-beta-transformation of titanium, ziconium, and alloys of these materials. The purpose of the investigation was to explain the nature of the alpha-beta transformation from the position of modelling the configuration localization of valency electrons in atoms of the elements. The characteristics of a definite statistical weight of atoms with stable configurations by localization of a portion of the valency electrons are described. Author

N73-32457 Joint Publications Research Service, Arlington, Va.
STUDY OF SOME PROPERTIES OF ZIRCONIUM WITH ADDITIONS OF TRANSITION METALS c17

V. F. Filippov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 75-83 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 144-153 (For availability see N73-32441 23-18)

The effect of additions of d-transition metals on the microstructure, macrostructure, microhardness, and electrical resistance of cast zirconium was investigated. The investigation was conducted on binary alloys on a base of zirconium iodide. The alloys were prepared by the method of induction melting under vacuum conditions. Graphs are presented to show the effects of additives on the microhardness of zirconium samples. The effect of transition metals on the grain size of cast zirconium is analyzed. Author

N73-32458 Joint Publications Research Service, Arlington, Va.
RARE-EARTH METAL MODIFICATION OF TITANIUM c17

V. A. Kashchuk and A. I. Cherkashin *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 84-87 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 154-158 (For availability see N73-32441 23-18)

The effect of rare earth metals on the macrostructure, microstructure, strength, and ductility of cast titanium was studied. The chemical composition of the samples is described. The method of preparing the samples is discussed. Assimilation of titanium after-change was determined by chemical analysis. Calculated values of the content of additive and results of chemical analysis are presented. Author

N73-32459 Joint Publications Research Service, Arlington, Va.
INCREASING THE PHYSICAL AND MECHANICAL PROPERTIES OF CERMETS

F. I. Chaplygin *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 88-94 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 159-166 (For availability see N73-32441 23-18)

The physical and mechanical properties of cermets are described. Specific applications of cermets in the metal working industry are reported with respect to the properties of the various cermets. Three types of cermets are identified as being under present production. Methods for altering the physical and mechanical properties of cermets are discussed. Author

N73-32460 Joint Publications Research Service, Arlington, Va.
EFFECT OF SCANDIUM, YTTRIUM, AND LANTHANUM OXIDES ON THE PROPERTIES OF NICKEL FERRITE

L. A. Alekseyuk *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 95-99 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 166-169 (For availability see N73-32441 23-18)

The properties of nickel ferrite following addition of scandium, yttrium, and lantham oxides are reported. The chemical composition of the ferrites produced by the joint deposition of the hydroxides of the corresponding metals is identified. The results of an X-ray analysis to determine the single phase structure of the nickel ferrite are discussed. The electrical and magnetic properties of the ferrites are shown in tabular form. Author

N73-32461 Joint Publications Research Service, Arlington, Va.
INTERACTION OF TRANSITION METAL CARBIDES WITH SILICON c17

E. V. Kutysheva *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 100-105 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 204-210 (For availability see N73-32441 23-18)

The interaction of powders of carbides of zirconium, niobium, and molybdenum with silicon was studied. Zirconium carbide, niobium carbide, molybdenum carbide, and silicon, previously cleaned from impurities, were studied. The reaction was done in a vacuum. The initial components were taken in a ratio of 50:50 mole %, test duration was one hour, and a temperature interval of 900-1900 C was investigated. Results of the tests were evaluated from X-ray and chemical phase analysis data. Results of the tests on the effect of temperature on the reaction products of ZrC with silicon are presented. Author

N73-32462 Joint Publications Research Service, Arlington, Va.
FRACTIONATION OF FINE METALLIC POWDERS c17

A. F. Shapoval *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 106-109 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 217-221 (For availability see N73-32441 23-18)

Air separation in rising air in combination with subsequent separation of the solid phase from the gas medium in a cyclone is used in a unit for separating fine powders into fractions. Air, being drawn through by the air blow in the system, is controlled by a rotameter. Powder is poured into the feeder located in the bottom part of the a vertical pipe and, for a specified amount of air passing through the powder, a fluidized bed is created. The powder is carried by the air flow from the feeder to the vertical glass pipe with a diameter of 100 mm and particles, which have an oddy velocity less than the air movement velocity in the pipe, are carried by the flow with the general mass of dispersed material. Author

N73-32463*# Southern Research Inst., Birmingham, Ala. Applied Thermal Section.
THE THERMAL AND MECHANICAL PROPERTIES OF A LOW DENSITY ELASTOMERIC ABLATION MATERIAL Technical Report, Apr. 1972 - Jul. 1973

W. T. Engelke, R. W. Robertson, A. L. Bush, and C. D. Pears Sep. 1973 224 p refs
(Contract NAS1-11499)
(NASA-CR-132281) Avail: NTIS HC $13.25 CSCL 11D

Thermal and mechanical properties data were obtained for a low density elastomeric resin based ablation material with phenolic-glass honeycomb reinforcement. Data were obtained for the material in the charred and uncharred state. Ablation material specimens were charred in a laboratory furnace at temperatures in the range from 600 K to 1700 K to obtain char specimens representative of the ablation char layer formed during reentry. These specimens were then used to obtain effective thermal conductivity, heat capacity, porosity, and permeability data at the char formation temperature. This provided a boxing of the data which enables the prediction of the transient response of the material during ablation. Limited comparisons were made between the furnace charred specimens and specimens which had been exposed to simulated reentry conditions. Author

N73-32464*# Little (Arthur D.), Inc., Cambridge, Mass.
TO IMPROVE THE FLAME RESISTANCE OF SPANDEX ELASTIC ELASTOMERIC FIBER

Jul. 1972 62 p
(Contract NAS9-10424)
(NASA-CR-128505; Rept-72210) Avail: NTIS HC $5.25 CSCL 11D

Strength characteristics of fibers were improved to pass the 70% oxygen/30% nitrogen specification. Spinning techniques and information about incorporating these fibers in fabric structures using wrapping materials of Beta Fiberglas, Nomex, and PBI were developed. Author

N73-32465*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF REUSABLE SURFACE INSULATION FOR SPACE SHUTTLE OVER A RANGE OF HEAT-TRANSFER RATE AND SURFACE TEMPERATURE

Andrew J. Chapman Washington Oct. 1973 28 p refs
(NASA-TM-X-2823; L-8787) Avail: NTIS HC $3.00 CSCL 11D

Reusable surface insulation materials, which were developed as heat shields for the space shuttle, were tested over a range of conditions including heat-transfer rates between 160 and 620 kW/sq m. The lowest of these heating rates was in a range predicted for the space shuttle during reentry, and the highest was more than twice the predicted entry heating on shuttle areas where reusable surface insulation would be used. Individual specimens were tested repeatedly at increasingly severe conditions to determine the maximum heating rate and temperature capability. A silica-base material experienced only minimal degradation during repeated tests which included conditions twice as severe as predicted shuttle entry and withstood cumulative exposures three times longer than the best mullite material. Mullite-base materials cracked and experienced incipient melting at conditions within the range predicted for shuttle entry. Neither silica nor mullite materials consistently survived the test series with unbroken waterproof surfaces. Surface temperatures for a silica and a mullite material followed a trend expected for noncatalytic surfaces, whereas surface temperatures for a second mullite material appeared to follow a trend expected for a catalytic surface. Author

N73-32466*# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
O(MINUS 2) GRAIN BOUNDARY DIFFUSION AND GRAIN GROWTH IN PURE DENSE MgO
C. M. Kapadia and M. H. Leipold [1973] 8 p refs
(Grant NGL-18-001-042)
(NASA-CR-135719) Avail: NTIS HC $3.00 CSCL 11D

Grain growth behavior in fully dense compacts of MgO of very high purity was studied, and the results compared with other similar behaving materials. The activation energy for the intrinsic self-diffusion of Mg(2minus) is discussed along with the grain boundary diffusion of O(2minus). Grain boundary diffusion of O(2minus) is proposed as the controlling mechanism for grain growth. F.O.S.

N73-32467*# United Aircraft Corp., East Hartford, Conn. Research Lab.
APPLICATION OF DIFFUSION BARRIERS TO THE REFRACTORY FIBERS OF TUNGSTEN, COLUMBIUM, CARBON AND ALUMINUM OXIDE Technical Report, May 1972 - Jun. 1973
F. C. Douglas, E. L. Paradis, and R. D. Veltri Sep. 1973 61 p refs
(Contract NAS3-15576)
(NASA-CR-134466) Avail: NTIS HC $5.50 CSCL 11D

A radio frequency powered ion-plating system was used to plate protective layers of refractory oxides and carbide onto high strength fiber substrates. Subsequent overplating of these combinations with nickel and titanium was made to determine the effectiveness of such barrier layers in preventing diffusion of the overcoat metal into the fibers with consequent loss of fiber strength. Four substrates, five coatings, and two metal matrix materials were employed for a total of forty material combinations. The substrates were tungsten, niobium, NASA-Hough carbon, and Tyco sapphire. The diffusion-barrier coatings were aluminum oxide, yttrium oxide, titanium carbide, tungsten carbide with 14% cobalt addition, and zirconium carbide. The metal matrix materials were IN 600 nickel and Ti 6/4 titanium. Adhesion of the coatings to all substrates was good except for the NASA-Hough carbon, where flaking off of the oxide coatings in particular was observed. Author

N73-32468*# Hughes Aircraft Co., Culver City, Calif.
FORMULATION AND PRODUCTION OF INTUMESCENT COATING SYSTEMS
Jack Hoffman and Harry R. Schwartz [1973] 84 p refs
(Contract NAS2-6387)
(NASA-CR-114470) Avail: NTIS HC $6.25 CSCL 11C

Methods for manufacturing and producing fire protective intumescent coatings are described. The coatings consist of three reactive parts mixed together at the time of use. The chemical composition of the reactive parts is discussed. The characteristics of the coatings which are obtained by three types of processing are analyzed. Qualification tests of the materials to determine acceptability are reported. Author

N73-32469*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPILATION OF OUTGASSING DATA FOR SPACECRAFT MATERIALS
William Campbell, Jr., Richard S. Marriott, and John J. Park Washington Sep. 1973 196 p
(NASA-TN-D-7362; G-7327) Avail: NTIS HC $5.25 CSCL 11D

Outgassing data, consisting of percentage weight loss and percentage volatile condensable materials, have been compiled from results obtained at Goddard Space Flight Center and at Stanford Research Institute. The data are assembled categorically and alphabetically to aid materials engineers, disigners, and manufacturers in selecting materials with low outgassing properties. Author

N73-32470# CIBA-GEIGY (UK) Ltd., Cambridge (England). Bonded Structures Div.
THE APPLICATION OF ADHESIVE BONDED STRUCTURES AND COMPOSITE MATERIALS ON ADVANCED TURBOFAN ENGINES
E. M. Pendlebury 23 Jun. 1972 33 p Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $3.75

The aero engine industry has a special interest in high temperature adhesives which will withstand environmental exposure more rigorous than most other applications. It is also essential that such systems, be they of glass, carbon, prepreg form, or standard adhesives, are capable of easy production handling and have realistic shelf life properties. There is continuing development in this area and manufacturers of structural adhesives and honeycomb collaborate to a considerable extent with aero engine manufacturers on these subjects. It should be possible in the not too distant future to replace, on a cost basis, existing brazing and welding techniques by bonding, but not until sufficient confidence is gained, which can only be achieved by extensive long term development testing and in-service experience. Author

N73-32471# Siemens-Schuckertwerke A.G., Erlangen (West Germany). Fachbereich Werkstoffe/Qualitaetsstelle.
FIBER-REINFORCED MATERIALS WITH METAL AND CERAMIC MATRIX [FASERVERSTAERKTE WERKSTOFFE MIT METALL-UND KERAMIKMATRIX]
Hermann Walter Gruenling Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1973 95 p refs In GERMAN; ENGLISH summary
Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-73-08) Avail: NTIS HC $6.75; ZLDI, Munich 19.55 DM

The manufacturing and testing of fiber reinforced, metal matrix, composite materials are reported. The systems are based on the matrix materials Ni and NiCr20, and Al1203 and SiC fibers and whiskers, as well as W and Mo wire as fiber materials. ESRO

N73-32472# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
GLASSY CARBONS Semiannual Progress Report, 1 Jan. - 30 Jun. 1973
Edward E. Hucke Jun. 1973 104 p refs
(Contract DAHC15-71-C-0283; ARPA Order 1824)
(AD-763499; UMich-010199) Avail: NTIS CSCL 11/2

Measurements of the physical and mechanical properties of a large number of glassy carbon samples produced from controlled pyrolysis of furfural alcohol resins demonstrated that the structure can be tailored very substantially. The ability to control properties such as density and fine structure leads to interesting and potentially useful mechanical, physical, and chemical properties. Section thickness in excess of 2 inches have been achieved in very fine pored (-100A) glassy carbons in processing times of less than six days. The carbon's fine structure determined by electron microscopy, electron diffraction and X-ray diffraction is not homogeneous on a size scale below 100 Angstroms. Thermodynamic measurements of the configurational enthalpy

and entropy of various glassy carbons relative to graphite confirms that their structures are significantly different. GRA

N73-32473# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF HIGH-TEMPERATURE-RESISTANT ELASTOMERIC SEALANT Final Report, 12 Apr. 1972 - 11 Apr. 1973
A. E. Senear Apr. 1973 50 p refs
(Contract N00019-72-C-0353)
(AD-764589; D6-60216) Avail: NTIS CSCL 07/3

A one-year program aimed at synthesizing fluorosilicone-hydrofluorocarbon copolymers is reported. Such copolymers were desired as bases for formulating improved pressure sealants for advanced aircraft. Dehydrofluorination of commercial hydrofluorocarbon polymers (Vitons) is described. Attempts to modify chemically dehydrofluorinated Vitons into intermediates capable of cocuring with commercially available fluorosilicones are discussed. Syntheses of some required silane intermediates are given. Preliminary cocuring studies are presented. Some evidence for formation of hydrofluorocarbon-fluorosilicone copolymers was obtained; however, no materials suitable for sealant use were synthesized. Author (GRA)

N73-32474# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
RESINS FOR ADVANCED REENTRY SYSTEMS APPLICATIONS Final Report, 1 Jul. 1971 - 31 Jan. 1973
Gerd H. Dahl, James P. King, and Peter B. Block Mar. 1973 45 p refs
(Contract N00014-72-C-0174)
(AD-764630) Avail: NTIS CSCL 11/4

Metal-loaded carbon and graphite-cloth reinforced composites were prepared from blends of poly(phenylquinoxaline) and poly(metal phosphinates) of zirconium, hafnium, tantalum, lead, or uranium. The flexural strengths of composite samples containing equal weights of the two polymers in the resin phase ranged from 13,000 to 32,000 psi. The corresponding values for laminates in which the resin phase contained 80 per cent of a poly(metal phosphinate) ranged from 4,500 to 17,000 psi. All laminates had low void contents. Pyrolysis of the laminates produced cohesive structures having flexural strengths of 3,000 to 6,000 psi. The strength values increased to 7,000 to 10,000 psi after the samples were reimpregnated with a furfuryl alcohol resin and repyrolyzed. The pyrolysis results are discussed. GRA

N73-32475# Westinghouse Research Labs., Pittsburgh, Pa. Material Sciences Dept.
FABRICATION AND PROPERTIES OF SILICON COMPOUNDS Final Report, 15 Mar. 1972 - 15 Mar. 1973
F. F. Lange and G. R. Terwilliger 15 Apr. 1973 103 p refs
(Contract N00019-72-C-0278)
(AD-764639; Rept-73-9D4-SERAM-R1) Avail: NTIS CSCL 11/2

The hot-pressing behavior of SiC with additions of Al2O3 was investigated. It was found that a liquid phase was formed at temperatures = 1900C, which caused densification by a solution-reprecipitation mechanism. Al2O3 was identified as a second phase in the dense bodies. The phenomenon of pressureless sintering of Si3N4 (- 5 wt % MgO) powders was studied. Densities of 90% theoretical and flexural strengths of 60,000 psi could be achieved. The densification behavior can be viewed as a competition between weight loss due to decomposition and shrinkage due to liquid phase sintering. The critical load required to induce surface damage into dense Si3N4 and SiC with a spherical indenter was determined. (Modified author abstract) GRA

N73-32476# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
FRACTURE BEHAVIOR OF SIMPLE COMPOSITES Final Report, Sep. 1969 - Jun. 1972
James A. Roberson Jul. 1973 12 p refs
(AF Proj. 7021)
(AD-765166; ARL-73-0108) Avail: NTIS CSCL 13/8

The work was intended to examine the interactions between the plastic zone at the tip of an advancing crack and the elastic stress field generated by a pre-existing micro-crack in its path. It was anticipated that diffusion bonding would provide a means for preparing specimens which were essentially perfect except for micro-cracks which were to be introduced by machining very small notches in the mating surfaces before bonding. It was found that diffusion bonding of Ti-6Al-4V alloy produced either very good or very poor bonds. The conditions required for the production of very good bonds made the introduction of micro-cracks unfeasible. Perfect bonds were obtained in Ti-6Al-4V alloy. Author (GRA)

N73-32477# Southern Research Inst., Birmingham, Ala.
AN EVALUATION OF MATERIAL FOR INVESTIGATION Final Report, 15 Apr. 1966 - 30 Sep. 1971
J. R. Brown, Jr., R. J. Bickelhaupt, H. S. Starrett, and C. D. Pears Oct. 1972 255 p refs
(Contract AF 33(615)-3265; F33615-70-C-1468; AF Proj. 7350)
(AD-764795; AFML-TR-72-219) Avail: NTIS CSCL 11/2

Of primary importance for the completion of the program was the production of parts with a wide range of sizes and shapes which could be made in quantity under production conditions with a minimum of material variability. Work on this program was terminated before complete reproducibility was demonstrated for all blank shapes. The material used for this investigation was a high purity alumina. Of the 13 blank types investigated, 10 demonstrated the desired uniformity and reproducibility, 1 was slightly deficient, and 2 require additional work. Attempts at demonstrating lot to lot reproducibility were generally unsuccessful. (Modified author abstract) GRA

N73-32478# Brown Univ., Providence, R.I. Dept. of Chemistry.
INTERIONIC VIBRATIONS AND GLASS TRANSITIONS IN IONIC OXIDE METAPHOSPHATE GLASSES
Gregory J. Exarhos, Philip J. Miller, and William M. Risen, Jr. 13 Aug. 1973 46 p refs Submitted for publication
(Contract N00014-67-A-0191-0024; NR Proj. 051-539)
(AD-765344; TR-73-02) Avail: NTIS CSCL 07/4

The far infrared spectrum of each ionic metal-metaphosphate glass, (MPO3)n (M = Li, Na, K, Rb, Cs) and (M(PO3)2)n (M = Ca, Sr, Ba), contains a broad absorption band whose peak frequency and halfbandwidth are strongly dependent on the mass and charge of the glass-modifying cation. Each such band, which appears as the envelope of the optical phonon spectrum of the crystalline form of the material, is assigned to a density of coupled oscillator pseudo phonon states, which assignment is shown to be consistent with experimental linear variations of frequency with bandwidth. The net effect of coupling the oscillators in the vitreous (disordered) system is equivalently treated as a single damped harmonic oscillator. The damping coefficient is constant in each series as is the complex part of the refractive index. The force constant, the excitation quantum number, and mean square amplitudes are computed. It is shown that the energy required to pull the anion site away from the cation, permitting the glass transition to ensue, is a constant for each series of metaphosphate glasses. GRA

N73-32479# General Electric Co., Schenectady, N.Y.
IMPACT STUDIES OF POLYMERIC MATRICES Final Report, 3 Jan. 1972 - 2 Feb. 1973
William B. Hillig Mar. 1973 84 p refs
(Contract N00019-72-C-0218)
(AD-764628; SRD-73-091) Avail: NTIS CSCL 11/9

The report is concerned with measuring, analyzing, and ultimately predicting the response and damage that results when a hard object of known mass, velocity, and curvature strikes the semi-infinite material of interest. Three polymers were selected: polymethyl methacrylate (PMMA), polycarbonate (PC), and epoxy. The work consisted of: Developing the capability for precise velocity control of 4.5 mm diameter steel projectiles to at least 1000 ft/sec; processing of stress-pulse signal to determine initial pulse shape; making preliminary impact investigation to determine thicknesses needed, and to estimate plastic versus elastic contributions; making low velocity impact studies to facilitate comparison with standard physical measurements; determining a suitable parametric empirical law for describing the data; computing the (effective) relaxation modulus which results from application of visco-elastic theory to the parametric

force law; developing the necessary mathematical structure and computer programs. Low velocity impact provides a sensitive mechanical fingerprint of the materials and serves as a useful base for investigating higher velocity impacts. (Modified author abstract) GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-32480 North Carolina Univ., Chapel Hill.
A MULTI-CRITERIA RESOURCE ALLOCATION DECISION AID Ph.D. Thesis
Belinda Hill Adams 1972 144 p
Avail: Univ. Microfilms Order No. 73-16444

The methodology developed is intended to serve as a resource allocation decision aid in situations where a multi-criteria evaluation of alternatives is appropriate. In order to accomplish an improvement in these areas, the methodology structures the real world problem in a manner which facilitates the use of an unusual judgment coordination procedure and which permits an organization to utilize the specialized expertise of its personnel to obtain a composite organizational value for each proposed alternative. This, in turn, facilitates the application of mathematical optimization techniques, making it possible to identify a combination of proposed alternatives which maximizes research package value. The Space Shuttle Program of the National Aeronautics and Space Administration afforded an opportunity for coupling the theoretical development with the testing of the model under conditions in which model simplifications were unusually applicable. Specifically, the methodology was applied to the selection of a space shuttle experiment package. Though the methodology is particularly suited to R and D resource allocation decisions, certain minor modifications are suggested which will significantly broaden the applicability of the approach. Dissert. Abstr.

N73-32481 Case Western Reserve Univ., Cleveland, Ohio.
A MESH GRADIENT TECHNIQUE FOR NUMERICAL OPTIMIZATION Ph.D. Thesis
Edward Allen Willis, Jr. 1973 183 p
Avail: Univ. Microfilms Order No. 73-16173

A class of successive improvement optimization methods is reported in which directions of descent are defined in the state space along each trial trajectory. The given problem is first decomposed into two discrete levels by imposing mesh points. Level 1 then consists of running optimal subarcs between each successive pair of mesh points. For normal systems, these optimal two point boundary value problems can be solved by following a routine prescription if the mesh spacing is sufficiently close. A spacing criterion is given. In level 2 the gradient data is used to generate improvement steps or search directions in the state space which satisfy the boundary values and constraints of the given problem. Dissert. Abstr.

N73-32482*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
INPUT FREQUENCY REQUIREMENTS FOR IDENTIFICATION THROUGH LIAPUNOV METHODS
C. H. Kim and D. P. Lindorff Jul. 1973 40 p refs
(Grant NGL-07-002-002)
(NASA-CR-135668; TR-73-5) Avail: NTIS HC $4.00 CSCL 12A

A theorem is derived which specifies a sufficient number of input frequencies to guarantee identification of an unknown noise free linear plant. Since all of the referenced work relates to sufficient conditions for nulling of the parameter error vector, it is to be expected that various conditions on the system to be identified will have been imposed. It was found that some of these conditions appear to be necessary while others do not. The main contribution is to provide a theorem which considers the effect of unknown parameters in the state equation upon the frequency requirements. Author

N73-32483*# California Univ., Santa Barbara.
REFLECTING SOLUTIONS OF HIGH ORDER ELLIPTIC DIFFERENTIAL EQUATIONS IN TWO INDEPENDENT VARIABLES ACROSS ANALYTIC ARCS Ph.D. Thesis
Oleg Carleton Jun. 1972 87 p refs
(Grant NGL-05-010-008)
(NASA-CR-135667) Avail: NTIS HC $6.50 CSCL 12A

Consideration is given specifically to sixth order elliptic partial differential equations in two independent real variables x, y such that the coefficients of the highest order terms are real constants. It is assumed that the differential operator has distinct characteristics and that it can be factored as a product of second order operators. By analytically continuing into the complex domain and using the complex characteristic coordinates of the differential equation, it is shown that its solutions, u, may be reflected across analytic arcs on which u satisfies certain analytic boundary conditions. Moreover, a method is given whereby one can determine a region into which the solution is extensible. It is seen that this region of reflection is dependent on the original domain of difinition of the solution, the arc and the coefficients of the highest order terms of the equation and not on any sufficiently small quantities; i.e., the reflection is global in nature. The method employed may be applied to similar differential equations of order 2n. Author

N73-32484*# General Electric Co., Philadelphia, Pa. Space Systems Organization.
REDUCTION OF TRUNCATION ERRORS IN MODAL ANALYSIS Final Report
E. J. Kuhar and C. V. Stahle 29 Jun. 1973 114 p refs
(Contract NAS8-28167)
(NASA-CR-124446; GE-73SD4251) Avail: NTIS HC $7.75 CSCL 12A

A condensation method and computer program are described for large discrete parameter vibration analysis of complex structures that greatly reduces truncation errors and provides accurate definition of modes in a selected frequency range. A dynamic transformation is obtained from the partitioned equations of motion that relates modes not explicitly in the condensed solution to the retained modes at a selected system frequency. The generalized mass and stiffness matrices, obtained with existing modal synthesis methods, are reduced using this transformation and solved. Revised solutions are then obtained using new transformations at the calculated eigenvalues and are also used to assess the accuracy of the results. Computations are made tractable by simplified forms of the transformation that result with various modal synthesis methods. Three examples using the dynamic transformation in conjunction with a General Electric stiffness coupling method and the method of Craig and Bampton indicate large reductions in truncation errors and demonstrate the method for sequential groups of modes. Author

N73-32485*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
DEGENERATE R-S PERTURBATION THEORY
Joseph O. Hirschfelder and Phillip R. Certain 10 Aug. 1973 83 p refs
(Grant NGL-50-002-001; NSF GP-28213-A1; DA-ARO(D)-31-124-G179)
(NASA-CR-135641; WIS-TCI-500) Avail: NTIS HC $6.25 CSCL 12A

A concise, systematic procedure is given for determining the Rayleigh-Schrodinger energies and wave functions of degenerate states to arbitrarily high orders even when the degeneracies of the various states are resolved in arbitrary orders. The procedure is expressed in terms of an iterative cycle in which the energy through the $(2n+1)$st order is expressed in terms of the partially determined wave function through the n-th order. Both a direct and an operator derivation are given. The two approaches are equivalent and can be transcribed into each other. The direct approach deals with the wave functions (without the use of formal operators) and has the advantage that it resembles the usual treatment of nondegenerate perturbations and maintains close contact with the basic physics. In the operator approach, the wave functions are expressed in terms of infinite order operators which are determined by the successive resolution of the space of the zeroth order functions. Author

N73-32486*# Houston Univ., Tex.
ON MINIMIZING THE PROBABILITY OF MISCLASSIFICATION FOR LINEAR FEATURE SELECTION
L. F. Guseman, Jr. and Homer F. Walker Aug. 1973 42 p refs Prepared in cooperation with Tex. A and M Univ., Coll. Station and Tex. Technol. Univ., Lubbock
(Contract NAS9-12777)
(NASA-CR-134058; JSC-08412) Avail: NTIS HC $4.25 CSCL 12A

The use of techniques for feature selection permits treatment of classification problems in spaces of reduced dimensions. A method is considered of linear feature selection for n-dimensional observation vectors which belong to one of two populations, where each population is described by a known multivariate normal density function. More specifically, the problem of finding a 1xn transformation matrix B for which the probability of misclassification with respect to the one-dimensional transformed density functions was minimized was considered. Theoretical results are presented which give rise to a numerically tractable expression for the variation in the probability of misclassification with respect to B. Using this expression a computational procedure is discussed for obtaining a B which minimizes the probability of misclassification. Preliminary numerical results are discussed.
Author

N73-32487*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A COMPARISON OF DIGITAL COMPUTER PROGRAMS FOR THE NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS
Hugo L. Ingram 1 Jul. 1973 108 p refs
(NASA-TM-X-64781) Avail: NTIS HC $7.50 CSCL 12A

Recently the determination of the best technique for numerically solving systems of ordinary differential equations on a digital computer has received much attention. The use of these formulas in conjunction with a stepsize control developed is explained, and one of the formulas is chosen for comparison with other integration techniques. This comparison of one of the best of Fehlberg's formulas with the different numerical techniques described in previous studies on a variety of test problems clearly shows the superiority of Fehlberg's formula. That is, on each of the test problems, the chosen Fehlberg formula is able to achieve a given accuracy in less computer time than any of the other techniques tested. Also, the computer program for the chosen Fehlberg formula is less complex and easier to use than the computer programs for most of the other techniques. To illustrate the use of the chosen Fehlberg formula, a computer listing of its application to several example problems is included along with a sample of the computer output from these applications.
Author

N73-32488# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
GENERAL PROBLEMS ON THE JOB-SHOP SCHEDULING. DEFINITIONS, CRITERIA, PRINCIPAL METHODS [PROBLEM GENERAL DE L'ORDONNANCEMENT D'ATELIER. DEFINITIONS, CRITERES, PRINCIPALES METHODES]
J. Erschler, F. Roubellat, and J. P. Vernhes Jun. 1973 22 p refs In FRENCH
(LAAS-OD-73-I-21) Avail: NTIS HC $3.25

An application of the set and probability theory to general job-shop scheduling is presented. Basic hypothesis, processes, and scheduling variables are described. Performance measurement, stockpiling, execution time and scheduling problem classification are discussed. Active, semi-active, no delay scheduling and scheduling generation procedures are defined, and examples of statistical studies given. An optimal solution for the case of n tasks on m machines with specified movement of products in the job-shop is presented using linear programming.
ESRO

N73-32489# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE LEAST-SQUARES FITTING OF CUBIC SPLINE SURFACES TO GENERAL DATA SETS
J. G. Hayes and J. Halliday (Brit. Aircraft Corp.) Dec. 1972 33 p refs Presented at the SIAM-SIGNUM Fall Meeting, Austin, Tex., Oct. 1972
(NPL-NAC-22) Avail: NTIS HC $3.75

A computational method, with several variants, for fitting bicubic splines by least squares to data given at arbitrary points is presented. Products of B-splines are used in the representation of the bicubic splines. The resulting observation equations are solved by means of Householder transformations. A stable method for imposing linear equality constraints is also described. The methods take into account rank-deficiency and are readily extended to more dimensions.
Author (ESRO)

N73-32490# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
TREATMENT OF SINGULARITIES IN THE SOLUTION OF LAPLACE'S EQUATION BY AN INTEGRAL EQUATION METHOD
George T. Symm Jan. 1973 35 p refs
(NPL-NAC-31) Avail: NTIS HC $3.75

Boundary singularities in the solution of a partial differential equation tend to slow down the rate of convergence with decreasing mesh size for any standard numerical method for obtaining this solution. This difficulty is overcome in the solution of Laplace's equation in two dimensions by an integral equation method. The basic method, which is applicable to quite general boundary-value problems, is modified to take into account the analytic form of each singularity without appreciably increasing the amount of computation involved. The modified method is applied to a variety of examples, and numerical results are given.
Author (ESRO)

N73-32491# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
OPERATIONS HANDBOOK ON ESTIMATION OF REAL TIME PARAMETERS ON T2000 [DOSSIER D'UTILISATION ESTIMATION DE PARAMETRES EN TEMPS REEL SUR T2000]
G. Continente Feb. 1973 28 p In FRENCH
(LAAS-AS-73-I-06) Avail: NTIS HC $3.50

A computer program for multidimensional linear system parameter estimation is presented. A discrete mathematical model with l inputs, m outputs, and partial order p is given in matrix form; and the expressions for least squares method estimators of the mean, and noise covariance matrix are detailed. The program is written in ASMAT language for the T2000 computer with minimal 8K words configuration. Detailed program and subprogram flow charts are given.
ESRO

N73-32492# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
STABILITY OF MULTIPLE-LOOP NONLINEAR TIME-VARYING SYSTEMS
Anthony N. Michel and D. W. Porter Jul. 1973 126 p refs
(Contract N00014-68-A-0162; ERI Proj. 712-S)
(AD-764631; ISU-ERI-AMES-73167) Avail: NTIS CSCL 12/1

Sufficient conditions for the input-output stability of multiple-loop systems, in the frequency domain and in the time domain, are established. Both gain results and sector results are presented. In all cases the objective is the same; to analyze complex systems in terms at their subsystems and in terms of their interconnecting structure. In order to demonstrate the usefulness of the method advanced, three specific examples are considered. These include: an interconnection of three linear time-invariant elements with a linear time-varying element, a piecewise linear element, and a hysteresis nonlinearity; a network formed from the interconnection of two passive elements with a nonlinear time-varying resistance and a nonlinear time-varying conductance; a third-order nonlinear time-varying differential equation involving time delay.
Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-32493 World Meteorological Organization, Geneva (Switzerland).
THE INTERNATIONAL RADIOMETERSONDE INTERCOMPARISON PROGRAMME (1970 - 1971)
John C. Gille and Peter M. Kuhn 1973 143 p refs
(WMO-358; TN-128) Copyright. Avail: Issuing Activity

Comparisons of American, Japanese, and U.S.S.R. radiometersonde measurements are analyzed. For individual titles, see N73-32494 through N73-32495.

N73-32494 World Meteorological Organization, Geneva (Switzerland).
DESCRIPTION OF THE INTERCOMPARISON PROGRAM
Peter M. Kuhn *In its* The Intern. Radiometersonde Intercomparison Programme (1970 - 1971) 1973 p 3-8 ref (For availability see N73-32493 23-20)
Copyright.

The procedures are described for comparing Japanese, American, and German radiometersondes aboard the oceanographic vessel Discoverer, on a cruise from Miami through the Panama Canal to 8 deg S in the Pacific. The results of these balloon flights are tabulated. Flights of radiometers of Japan, U.S., and U.S.S.R. at Tateno Aerological Observatory, near Tokyo, are also discussed. F.O.S.

N73-32495 World Meteorological Organization, Geneva (Switzerland).
ANALYSIS OF INTERCOMPARISON PROGRAM RESULTS
John C. Gille *In its* The Intern. Radiometersonde Intercomparison Programme (1970 - 1971) 1973 p 9-51 refs (For availability see N73-32493 23-20)
(Grant NSF GA-19542)
Copyright.

The analysis is reported of the radiometersonde comparisons. Topics discussed include: analysis procedures, selection and grouping of soundings, results of clear sky conditions, results of overcast sky conditions, comparison with surface flux measurements, comparison between observed and calculated fluxes and heating rates. The systematic differences in the instruments are analyzed for various fluxes. F.O.S.

N73-32496 Miami Univ., Fla.
AN ANALYTICAL AND NUMERICAL MODEL OF THE SEA BREEZE Ph.D. Thesis
Robert Allan Pearson 1973 310 p
Avail: Univ. Microfilms Order No. 73-16863

A scale analysis is used to show which terms in the equations of motion are important in the development of the sea breeze. The equations of the model include all nonlinear terms and earth rotation. The model is two dimensional and does not attempt to include the effects of bays in the coastline or rain. The equivalent linearized model is examined for the effect of the earth's rotation on the sea breeze. In comparison with the nonrotating model the inclusion of rotation decreases the horizontal velocity component perpendicular to the coastline. It introduces a component paraellel to coast which at first increases with time and then oscillates about its final mean value. The mean flow is geostropic and is confined to narrow re-ion around the coastline. Dissert. Abstr.

N73-32497# National Meteorological Center, Washington, D.C.
NUMERICAL WEATHER PREDICTION ACTIVITIES, FIRST HALF OF 1973
1973 40 p
Avail: NTIS HC $3.00

The numerical weather prediction activities of the National Meteorological Center (NMC) for the first half of 1973 are summarized. There were no changes made in the operational six-layer primitive equation model during this period. Operational changes were made in the area of integration and the lateral boundary conditions of the limited-area fine-mesh model. Reference to an error in the NMC forecast geostropic wind statistics is made. Approximate correction factors to be used on published statistics prior to July 1972 are given. The reorganization of the development division, the research arm of the NMC, is summarized under four headings: global modeling branch, regional modeling branch, data assimilation branch, and upper air branch. Of particular interest is an effort in hurricane modeling for operational purposes. Author

N73-32498# National Environmental Satellite Service, Washington, D.C.
AN EXAMINATION OF TROPICAL CLOUD CLUSTERS USING SIMULTANEOUSLY OBSERVED BRIGHTNESS AND HIGH RESOLUTION INFRARED DATA FROM SATELLITES
Arnold Gruber Sep. 1973 25 p refs
(NOAA-TM-NESS-50) Avail: NTIS HC $3.25

In an attempt to infer the convective activity of tropical cloud clusters, a study was made of simultaneous observations of infrared (10 to 12 micrometers) and reflected energy (0.55 to 0.75 micrometers) measured by the scanning radiometer flown aboard the NOAA 1 satellite. The brightest areas were not always coincident with the coldest areas. Correlation coefficients between equivalent blackbody temperatures and brightnesses were computed for five different ranges of brightness. The highest brightness ranges were poorly correlated with the equivalent blackbody temperatures. These results suggest that brightness enhancing techniques alone may not be adequate for the study of convective activity in cloud clusters. Author

N73-32499# Istituto di Fisica Dell Atmosfera, Rome (Italy).
A CLIMATOLOGICAL BIBLIOGRAPHY OF ITALY [BIBLIOGRAFIA CLIMATOLOGICA ITALIANA]
V. Cantu and P. Narducci Jan. 1973 38 p refs In ITALIAN
Prepared jointly with the Serv. Meteorol. of the Aeron. Mil. Ital.
(IFA-STR-22) Avail: NTIS HC $4.00

A bibliography of Italian climatology is presented. The list is chronological and covers the years 1880 to 1971. In addition to Italian literature some foreign literature is mentioned. ESRO

N73-32500# Direction de la Meteorologie Nationale, Paris (France).
STATISTICS OF EXTREME VALUES [SUR LA STATISTIQUE DES VALEURS EXTREMES]
J. Bessemoulin May 1973 24 p refs In FRENCH
(Mono-89) Avail: NTIS HC $3.25

Statistical weather forecasting utilizing the Gumbel theory is discussed, showing the limitations of the method. A validity test of the Gumbel law is detailed for a given, extreme range, statistic. Other forms of similar laws are described. Recurrence time and occurrence of events X (random variable) greater than X, probability law of appearance of extreme range values of X are discussed. An example is given using maximum annual temperatures in Paris. ESRO

N73-32501# Esso Research and Engineering Co., Linden, N.J. Government Research Lab.
A WORKING DOCUMENT FOR AIR POLLUTION MEASUREMENT TECHNIQUE DEVELOPMENT: FISCAL YEARS 1972-1977
Dec. 1971 218 p
(Contract CPA-22-69-154)
(PB-221011; APTD-1451; GRU.2GAPI.71) Avail: NTIS CSCL 13B

A research, development, test and evaluation plan for the environmental Protection Agency, covering the fiscal years 1972 through 1977 is presented. The plan will provide for development of air pollution measurement techniques: to support EPA research and investigations into the causes, effects, and extent of air pollution; to identify and quantify air pollutants; to assist in the setting of standards and to determine compliance with standards; and to support a continuing EPA effort to maintain adequate measurement capabilities. GRA

N73-32502# General Research Corp., Santa Barbara, Calif.
FIELD PROGRAM DESIGNS FOR VERIFYING PHOTOCHEMICAL DIFFUSION MODELS
A. Q. Eschenroeder, G. W. Deley, and R. J. Wahl Mar. 1973 57 p refs
(Contract EPA-68-02-0336)
(PB-221300/7; EPA-R4-73-012-Vol-C; GRC-CR-3-273) Avail: NTIS HC $5.00 CSCL 13B

Carefully designed experimental measurement programs are necessary to the task of collecting the extensive data base needed for testing air pollution models. In this paper a series of

recommendations is offered as input for field measurement programs. These recommendation update and refine suggestions made earlier. Some specific techniques and instrumentation are called for in certain cases, but in others only conceptual objectives are set forth. The report presents three specific conceptual plans. A description is presented of a data management system using the Los Angeles Reactive Pollutant Program (LARPP) as a prototype. It is concluded that future field programs must be structured to meet specific goals. The specific goals discussed here include verifying emissions models for vehicle populations, following photochemical transformations in a moving air mass, searching for turbulent reaction inhomogeneities in the atmosphere, and characterizing the interaction of gas phase species with aerosols. (Modified author abstract) GRA

N73-32503# Denver Univ., Colo. Dept. of Physics.
THEORETICAL STUDIES OF GROWTH OF MARINE FOG DROPLETS Final Report
Norihiko Fukuta, Vinod K. Saxena, and Norbet Nix Aug. 1973 59 p refs
(Contract N00014-67-A-0394-0007)
(AD-764597) Avail: NTIS CSCL 04/2

A general expression for the nonsteady-state growth or evaporation of droplets in gaseous media is obtained from simultaneous solution of the differential equations for vapor diffusion and heat conduction. It is assumed that environmental conditions of temperature and vapor density vary exponentially with time, and the Clausius-Clapeyron equation for the variation of the saturation vapor density with temperature is approximated by a linear relationship. The gas temperature and vapor density at the droplet surface are assumed to be in equilibrium with the droplet surface. Analytical solutions are obtained with the aid of the Laplace transformation. (Modified author abstract) GRA

N73-32504# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
LONG-RANGE TRANSPORT AND DIFFUSION EXPERIMENTS Final Report
Gilbert J. Ferber and Robert J. List May 1973 89 p refs
(ARPA Order 1841)
(AD-764893) Avail: NTIS CSCL 04/1

The purpose of the project is to investigate the feasibility of conducting long-range atmospheric tracer experiments to study transport and diffusion of air pollution plumes over continental distances. The study considered the feasibility of a series of experiments in which a tracer gas would be released in the western U.S. and cross-country air sampling would be carried out to determine the distribution of the tracer as a function of time and distance from the source, at ground level and aloft. Two main alternatives were considered. The first involves taking advantage of a source of opportunity, 85Kr emitted from a nuclear fuel reprocessing plant, to obtain long-range plume data. The second would use CF2Br2 or C2F4Br2. A short range evaluation was made using SF6 as a control tracer. GRA

N73-32505# Hawaii Univ., Honolulu. Dept. of Meteorology.
TROPICAL CYCLONES OF THE NORTH INDIAN OCEAN
James E. Sadler and Ross E. Gidley Monterey Calif. Naval Postgraduate School Mar. 1973 68 p refs
(Contract N00188-71-M-7003)
(AD-764859; UHMET-73-02;
ENVPREDRSCHF-Tech-Paper-2-73) Avail: NTIS CSCL 04/2

Photographs from polar-orbiting meteorological satellites were used in this study to obtain the frequency and tracks of depressions, storms, and hurricanes in the North Indian Ocean from November 1966 through December 1970 plus October 1971. The distribution of the mean sea-surface temperature, cloudiness, and atmospheric circulation for selected months are discussed in relation to the observed cyclone climatology. Appropriate and pertinent climatic charts of these parameters are presented. The results from the satellite period are compared with the 70-year (1891-1960) climatology of cyclonic storms from the India Meteorological Department (1964). Plotted cyclone tracks derived from satellite data are presented, as are plotted monthly tracks developed by the India Meteorological Department. Author (GRA)

N73-32506# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
CLASSIFICATION OF THE COASTAL ENVIRONMENTS OF THE WORLD. THE CLIMATIC REGIMES OF WESTERN SOUTH AMERICA: A CASE STUDY
Carlton Biscoe, Jr., Bruce Hayden, and Robert Dolan Jun. 1973 45 p refs
(Contract N00014-69-A-0060-0006; NR Proj. 389-158)
(AD-765355; TR-6) Avail: NTIS CSCL 04/2

The presence or absence of a distinct seasonally subdominate climatic regime along the midlatitude coast of Chile was determined through analyses of the temporal variation and relative influence of planetary scale atmospheric featues of the general circulation of the Southern Hemisphere. The objective of the report is to validate an aspect of the classifiction of coastal climates of the Americas and to establish the role of the general circulation of the atmosphere in the differentiation of climate of the west coasts of the Americas. Departures from hemispheric symmetry in the distribution of coastal climate are documented. Author (GRA)

N73-32507# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WEATHER AND LARGE-SCALE TURBULENCE
A. M. Bukov 30 Jul. 1973 13 p refs Transl. into ENGLISH from Tr. v Vses. Meteorl. S'Yezda, Sektsiya Prognoza Pogody (USSR), v. 2, 1972 p 3-7
(AD-764919; FTD-HT-23-805-73) Avail: NTIS CSCL 04/2

The largest-scale dynamic processes which envelop regions commensurable with the dimensions of our entire planet are investigated during the study of the overall circulation of the atmosphere using the theory of climate and long-range weather forecasting. In this case it is often advantageous to not individually examine disturbances of normal synoptic scale which determine the weather at an isolated point at a given moment. Weather, which is individually studied on ordinary synoptic charts, is changed into the elements of the macroturbulence of the atmosphere during statistical examination, where the basic emphasis is on the study of the regularities of atmospheric circulation on a global scale for long periods of time. GRA

N73-32508# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ESTABLISHMENT OF THE VERTICAL HUMIDITY PROFILE TO THE VERTICAL TEMPERATURE PROFILE
T. I. Baslova 26 Jul. 1973 17 p refs Transl. into ENGLISH from Tr. Arkticheskogoi Antarkt. Nauchn. Issled. Inlet. (Tashkent), v. 301, 1972 p 131-139
(AF Proj. 300521)
(AD-764949; FTD-HT-23-602-73) Avail: NTIS CSCL 04/2

In temperature sounding of the atmosphere by examining of absorption bands of carbon dioxide and molecular oxygen, it is necessary to take into account the attenuation of radiation by water vapor. The data obtained from radiosondes show that the vertical profiles of temperature and humidity in the atmosphere are closely interconnected. An empirical formula was proposed which correlates the change in moisture with the change in temperature and altitude. GRA

N73-32509# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PECULIARITIES OF ATMOSPHERIC FIELD DECOMPOSITION USING SYSTEMS OF ORTHOGONAL FUNCTION
G. A. Karpeev 27 Jul. 1973 23 p refs Transl. into ENGLISH from Tr. Leningrad Gidrometeorol. Nauchn. Issled. Tsentr. SSR (Leningrad), no. 64, 1970 p 69-80
(AD-764942; FTD-HT-23-674-73) Avail: NTIS CSCL 04/2

Atmospheric fields given by a fixed point system are studied for their vector properties. The correspondence between the space-time statistical structure of the fields and the statistical structure of vectors produced by them in an arithmetic space is considered. It is shown that in contrast to atmospheric field decomposition in orthogonal functions, the canonical decompositions are important when developing the linear statistical system of forecasting. G.G.

N73-32510# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DEVELOPMENT OF RADAR METHODS FOR STUDYING CLOUDS AND PRECIPITATION
V. V. Kostarev, Yu. V. Melnichuk, V. M. Muchnik, and L. M. Volynets 30 Jul. 1973 13 p Transl. into ENGLISH from Tr. v Vses. Meteorol. S'Yezda, Sektsiya Aktivnykh Vozdeistvii na Atmosfernye Protsessy (USSR), v. 4, 1972 p 173-177
(AD-764934; FTD-HT-23-806-73) Avail: NTIS CSCL 04/2

The report reviews the use of radar in the detection of clouds and precipitation. GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-32511 Purdue Univ., Lafayette, Ind.
INTERMITTENT POSITIVE CONTROL OF AIR TRAFFIC IN A HORIZONTAL PLANE Ph.D. Thesis
Alvin Leroy McFarland 1972 280 p
Avail: Univ. Microfilms Order No. 73-15835

The task of selecting a horizontal resolution maneuver is approached from the point of view of optimal control theory, choosing as a performance index to be minimized, the maneuver duration. One aircraft in the conflict maintains a constant velocity path. The problem reduces to that of selecting for the other aircraft the optimum flight path consisting of three circular arcs and two straight legs, which allows the two aircraft to pass with a separation no less than a specific value. The complete theoretical solution to the optimal control problem is stated. Because this exact solution is much too complex for use in practice, a suboptimal solution is proposed, and a means for evaluating the loss of optimality devised. The conflict resolution model and solution could also find application in an automated positive control environment, in a nationwide flow control system, and, with some adaptation, in terminal area metering and spacing schemes. Dissert. Abstr.

N73-32512# Mitre Corp., McLean, Va.
EVALUATION OF ATCRBS PERFORMANCE IN AN INTERFERENCE ENVIRONMENT Final Report
Stanley R. Jones Washington FAA Aug. 1972 218 p refs (Contract DOT-FA70WA-2448)
(MTR-6239; FAA-EM-73-4) Avail: NTIS HC $13.00

Uplink and downlink ATCRBS interference measurements in terminal areas were coordinated with assessments of the sources of these mutual interference conditions. The average values of these observations as well as many burst characteristics corroborated the results of an analytical model coupling the environmental features to their effects on the surveillance system. Simulation efforts based on statistical representation of the input conditions enabled an association of these interference levels with deterioration in performance of the ARTS III and TPX-42 processors. Results of these modeling efforts indicate that the performance of both processors is degraded for transponder reply probabilities below 0.85. Forecasts based on these results indicate that ARTS III performance degradation due to asynchronous interference may limit the terminal area traffic count to about 600 aircraft when approximately 40 interrogators are within view. Author

N73-32513# Collins Radio Co., Cedar Rapids, Iowa.
EVALUATION OF EXISTING VOR, LOCALIZER AND GLIDESLOPE RECEIVING EQUIPMENT, VOLUME 2, BOOK 2 Final Report
W. O. Ashby Feb. 1973 300 p refs
(Contract DOT-FA72WA-2772)
(FAA-RD-73-1-Vol-2-Bk-2;
Rept-523-0764695-00111M-V2-Bk2) Avail: NTIS HC $17.00

Tests of VHF Omnirange navigation system, localizer, and glideslope receiving equipment were conducted to determine performance under various conditions of radio frequency interference. The basic test results for each of the sixty one receivers tested are presented. The purpose of the test was to provide data on which to base geographic facility separations to avoid mutual electromagnetic interference. Author

N73-32514*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE GUIDANCE, NAVIGATION, AND CONTROL DESIGN EQUATIONS. VOLUME 3: GUIDANCE
15 Mar. 1973 403 p refs
(Proj. Space Shuttle)
(NASA-TM-X-69524; JSC-04217-Rev-D-Vol-3) Avail: NTIS HC $22.25 CSCL 17G

Space shuttle guidance, navigation, and control design equations are presented. The space-shuttle mission includes three relatively distinct guidance phases which are discussed; atmospheric boost, which is characterized by an adaptive guidance law; extra-atmospheric activities; and re-entry activities, where aerodynamic surfaces are the principal effectors. Guidance tasks include pre-maneuver targeting and powered flight guidance, where powered flight is defined to include the application of aerodynamic forces as well as thruster forces. A flow chart which follows guidance activities throughout the mission from the pre-launch phase through touchdown is presented. The main guidance programs and subroutines used in each phase of a typical rendezvous mission are listed. Detailed software requirements are also presented. Author

N73-32515*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT RESULTS FROM A STUDY OF AIDED INERTIAL NAVIGATION APPLIED TO LANDING OPERATIONS
Leonard A. McGee, Gerald L. Smith, Daniel M. Hegarty, Thomas M. Carson, Robert B. Merrick, S. F. Schmidt (Anal. Mech. Assoc., Inc., Mt. View, Calif.), and B. Conrad (Anal. Mech. Assoc., Inc., Mt. View, Calif.) Washington Oct. 1973 42 p refs
(NASA-TN-D-7302; A-4584) Avail: NTIS HC $3.00 CSCL 17G

An evaluation is presented of the approach and landing performance of a Kalman filter aided inertial navigation system using flight data obtained from a series of approaches and landings of the CV-340 aircraft at an instrumented test area. A description of the flight test is given, in which data recorded included: (1) accelerometer signals from the platform of an INS; (2) three ranges from the Ames-Cubic Precision Ranging System; and (3) radar and barometric altimeter signals. The method of system evaluation employed was postflight processing of the recorded data using a Kalman filter which was designed for use on the XDS920 computer onboard the CV-340 aircraft. Results shown include comparisons between the trajectories as estimated by the Kalman fiter aided system and as determined from cinetheodolite data. Data start initialization of the Kalman filter, operation at a practical data rate, postflight modeling of sensor errors and operation under the adverse condition of bad data are illustrated. Author

N73-32516# National Aviation Facilities Experimental Center, Atlantic City, N.J.
FIELD EVALUATION OF ARTS 2 B (TRACAB) Interim Report, Feb. - Apr. 1973
Robert A. Clark and James F. Zakers Oct. 1972 46 p
(FAA-NA-73-54; FAA-RD-73-119) Avail: NTIS HC $4.50

A programmable ARTS II B, non-tracking, beacon alphanumeric system was installed in a TRACAB configuration in a live air traffic control tower environment. Operational suitability and techniques to be used in the automation program for low-density terminal/towers were evaluated. The system was evaluated over a six-week period through collection of subjective data obtained from controller questionnaries. It was concluded that while suitable for application in a TRACAB environment and compatible with the controller, extensive modification to both display subsystem and software were required to improve its usefulness. Author

N73-32517# Flight Inspection National Field Office, Oklahoma City, Okla.
EVALUATION OF CLOSE-IN/SHORT TURN ON PATTERNS (ILS) Final Report
Harold R. Richards, Jr. and Frank Parr Washington Aug. 1973 41 p
(AFS Proj. 600-72-3)

(FAA-AFS-500-1) Avail: NTIS HC $4.25

It was suggested that increased IFR traffic could be accepted at an airport if it were possible for traffic controllers to feed some of the smaller aircraft into gaps in the flow of normal traffic. Flight tests were flown in a Cessna 310 to intercept an ILS localizer at distances of 1.0, 1.5, 2.0, 2.5 and 3.0 NM from the runway threshold to evaluate flyability factors. Nominal airspeed used in maneuvering and on the approach was 110 MPH (100 knots), giving a margin of 9 knots for turbulence over the maximum Category A airspeed of 91 knots. Intercept angles were 45 and 90 degrees to the localizer centerline. Glide slope interception altitude was 500 feet above ground level. All flight tracks were recorded by an APTAR radar system. It was found that ILS intercepts inside the outer marker caused full scale localizer needle deflection during the intercept maneuver, and that pilot opinion did not support implementation of the procedure as a standard operation. Author

N73-32518# National Aviation Facilities Experimental Center, Atlantic City, N.J.

SYSTEM INTEGRATION AND SYSTEM SHAKEDOWN TESTS, NAS ENROUTE STAGE A MODEL A3d1 Final Report, Sep. 1972 - Apr. 1973

Joseph Levy and Victor Crawford Oct. 1973 77 p

(FAA-NA-73-55; FAA-RD-73-135) Avail: NTIS HC $5.75

A series of tests of the national Air Space (NAS) Enroute Stage A Model A3dl System were conducted in a total system environment. Simulated and live radar inputs to evaluate the total system capability to accomplish the air traffic control task and to provide guidance for conduct of System Integration and System Shakedown tests at field facilities were conducted. The tests and the results obtained are described. Author

N73-32519# Technische Universitaet, Brunswick (West Germany). Inst. fuer Verkehr, Eisenbahnwesen und Verkehrssicherung-Sonderforschungsbereich Flugfuehrung.

DIGITAL SYNCHRONIZATION FOR TIME SYNCHRONOUS COLLISION AVOIDANCE SYSTEMS IN AVIATION [DIGITALE SYNCHRONISATION FUER ZEITSYNCHRONE KOLLISIONSSCHUTZSYSTEME DER LUFTFAHRT]

Peter Form 1973 18 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973

(DGLR-Paper-73-012) Avail: NTIS HC $3.00

Some problems in the digital synchronization of airborne collision avoidance systems are discussed. The economies of such existing time synchronous systems were investigated, and replacement of the relatively expensive onboard precision reference source by a synchronization of corresponding accuracy is proposed. This completion of time-synchronous systems is explained by describing the present state of the art. ESRO

N73-32520# Technische Universitaet, Brunswick (West Germany). Inst. fuer Verkehr, Eisenbahnwesen und Verkehrssicherung-Sonderforschungsbereich Flugfuehrung.

PRESENT STATUS OF ALL-WEATHER LANDING: PROBLEMS AND LIMITS [SCHLECHTWETTERLANDUNG HEUTE-IHRE PROBLEME UND GRENZEN]

Dirk Brunner 1973 13 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973

(DGLR-Paper-73-015) Avail: NTIS HC $3.00

The problems in aircraft landing under low visibility weather conditions are discussed. Most of these problems are based on the fact that ILS is not a landing system, but an approach aid. Its incompleteness has to be compensated with auxiliary equipment, such as radio altitude measurement, optical landing aids, ect. The decision of the pilot of land or not to land under certain weather conditions should be supported more than by present displayed information. The aritificial improvement of optical visibility is an interesting consequence. ESRO

N73-32521# Technische Universitaet, Brunswick (West Germany). Abteilung fuer Fernmelde- und Hochfrequenztechnik in der Verkehrssicherung.

POSSIBILITIES FOR IMPROVING THE CONVENTIONAL INSTRUMENT LANDING SYSTEM (ILS) [VERBESSERUNGSMOEGLICHKEITEN DES KONVENTIONELLEN INSTRUMENTENLANDESYSTEMS (ILS)]

H. Frilke 1973 18 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973

(DGLR-Paper-73-017) Avail: NTIS HC $3.00

Two possibilities for improving instrument landing systems were investigated. These deal with interferences during aircraft landing and gliding as a result of multipath propagation and variations of earth surface signal reflectivity. To minimize multipath propagation effects, which can be felt 12 km before touching ground, interference should be detected, and consequently suppressed. Methods to realize these steps are briefly described. Two methods to suppress the variable surface reflection, especially on the glide path are discussed; the formation of quotients in antenna reception signals, and the use of circular polarization. ESRO

N73-32522# Bundesanstalt fuer Flugsicherung, Frankfurt am Main (West Germany).

FLIGHT OPERATIONS AND GUIDE BEAM SYSTEMS [FLUGBETRIEB UND LEITSTRAHLSYSTEM]

T. Bohr 1973 13 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973

(DGLR-Paper-73-011) Avail: NTIS HC $3.00

The history and perspectives of the instrument landing system are presented. The present operational requirements for these systems, as endorsed by the ICAO, are formulated and discussed. ESRO

N73-32523# Standard Electrik Lorenz A.G., Stuttgart (West Germany).

DETAILS OF DLS AND SETAC LANDING AIDS [EINIGE BESONDERHEITEN DER LANDENHILFEN DLS UND SETAC]

K. D. Eckert and G. Peuker Apr. 1973 34 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973

(DGLR-73-019) Avail: NTIS HC $3.75

Two new instrument landing systems are described. These systems replace ILS, in view of its inherent problems, such as multipath propagation, increasing traffic, equipment volume, and application both in military and civil aviation. The SETAC system, short for sector-Tacan, is based on the military medium range navigation system Tacan and consists of two ground stations and a onboard ancillary device of Tacan equipment. The DLS system is based on DME in the L-band, from which the DME-supported landing system originated. The system allows distance measurements as follows: onboard request, ground transponder, and reply after exactly 50 microsec. The requests are received with special antenna arrays, allowing determination of azimuthal incidence angle, and elevation incidence angle. ESRO

N73-32524# Standard Electrik Lorenz A.G., Stuttgart (West Germany). Erzeugnisgebiet Navigation.

IMPROVEMENT OF STANDARD ILS WHILE RETAINING COMPATIBILITY [VERBESSERUNG DES STANDARD-ILS UNTER BEIBEHALTUNG DER KOMPATIBILITAET]

G. Hoefgen 1973 7 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973

(DGLR-Paper-73-018) Avail: NTIS HC $3.00

Two methods of improving the standard instrument landing system, while retaining compatibility, are presented. The compatible instrument landing system (CILS) consists of the following components: (1) standard ILS for clearance, and (2) microwave ILS 5 GHz, based on conventional priciple (90/150 Hz) only for approach sector. To be compatible with the existing two carrier systems with 9 kHz difference carrier frequency, the microwave oscillator frequency is also radiated. The precision instrument landing system (PILS), necessitates more onboard equipment and includes linear antenna arrays, consisting of elements sequentially radiating signals. An advantage over standard ILS is that the glide angle can be selected at random onboard. ESRO

N73-32525# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
MIXED CTOL/QTOL TRAFFIC [GEMISCHTER CTOL/QTOL-VERKEHR]
F. Schoenberger 15 Apr. 1973 30 p In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(MBB-UH-05-73-O; DGLR-Paper-73-014) Avail: NTIS HC $3.50

The results of the transition period when conventional air traffic (CTOL) will be replaced by quiet takeoff and landing (QTOL) traffic, are reviewed. The introduction of QTOL aircraft from about the year 1978 will entail the simultaneous operation of present CTOL and QTOL aircraft types. The effects of this transition period, to be felt by introduction of microwave instrument landing systems and area navigation, are surveyed. ESRO

N73-32526# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
FLIGHT PATH CONTROL EQUIPMENT FOR PRODUCING CURVED FLIGHT PATH PROFILES IN MICROWAVE LANDING SYSTEMS [FLUGBAHNFUEHRUNGSGERAET ZUM ERZEUGEN GEKRUEMMTER FLUGBAHNPROFILE AN MIKROWELLEN-LANDESYSTEMEN]
G. Schaenzer 1973 36 p refs In GERMAN Presented at the DGLR-DGON Symp. on Neue Anflug- und Landeverfahren, Duesseldorf, 2-4 May 1973
(DGLR-Paper-73-016) Avail: NTIS HC $4.00

The properties of a flight control display device for producing curved approach profiles, and the flight control along these profiles, are discussed in the case of a microwave instrument landing system. The prolems of maneuverability, accuracy, and the stability of aircraft motions are treated, and the requirements of the guide beam system and flight control system are formulated. Flight tests have shown that the methods discussed contribute to reduction of pilot workload. ESRO

N73-32527# Space Vector Corp., Canoga Park, Calif.
DEVELOPMENT AND FABRICATION OF AN IMPROVED DIGITAL ROLL STABILIZED GYRO PLATFORM Final Report, Nov. 1969 - Jan. 1972
Richard O. Rasmussen, Clayton D. Bushnell, George Kometani, and Stewart D. Lyon 20 Oct. 1972 12 p refs
(Contract F19628-70-C-0231; AF Proj. 7659)
(AD-764903; AFCRL-TR-73-0273) Avail: NTIS CSCL 17/9

In the field of sounding rocketry the necessity for a more sophisticated digital roll stabilized gyro platform with outputs compatible with PCM logic became apparent around 1969. Plans to initiate research and development of such a device were undertaken by AFCRL. Initial research and development resulted in the use of frictionless optical pick-offs and associated electronics to sense and convert the gyroscopic roll, pitch and yaw position data into digital binary information that could be used for either direct telemetry for attitude information of a sounding rocket payload or by feeding into electronic logic circuitry which in turn would initiate command signals to position the sounding rocket in space as required by the mission objective. The development also resulted in design of a servoed roll gimbal which isolated the gyros from vehicle spin. (Modified author abstract) GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-32528* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUCLEAR FUEL ELEMENTS Patent
Glen E. McDonald, inventor (to NASA) Issued 18 Sep. 1973 4 p
(NASA-Case-XLE-00209; US-Patent-3,759,787; US-Patent-Appl-SN-60276; US-Patent-Class-176-169) Avail: US Patent Office CSCL 18J

Tungsten-coated tungsten-uranium dioxide nuclear reactor fuel plates are described. The problem of leakage of U02 from tungsten-U02 fuel plates at elevated temperatures is solved. A tungsten-clad tungsten-U02 nuclear fuel plate is presented in which the tungsten coating and the tungsten cladding have few grain boundaries. Official Gazette of the U.S. Patent Office

N73-32529# Teledyne Isotopes, Timonium, Md. Energy Systems Division.
SNAP 19 PIONEER F AND G Final Report
Jun. 1973 152 p refs
(Contract AT(29-2)-2960)
(IESD-2873-172) Avail: NTIS HC $9.75

The generator developed for the Pioneer mission evolved from the SNAP 19 RTG's launched aboard the Nimbus 3 spacecraft. In order to satisfy the power requirements and environment of earth-escape trajectory, significant modifications were made to the thermoelectric converter, heat source, and structural configuration. Specifically, a TAGS-2N thermoelectric couple was designed to provide higher efficiency and improved long term power performance, and the electrical circuitry was modified to yield very low magnetic field from current flow in the RTG. A new heat source was employed to satisfy operational requirements and its integration with the generator required alteration to the method of providing support to the fuel capsule. Author

N73-32530*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FISSION-GAS-RELEASE RATES FROM IRRADIATED URANIUM NITRIDE SPECIMENS
Michael B. Weinstein, Thomas A. Kirchgessner, and Thomas N. Tambling Washington Oct. 1973 24 p refs
(NASA-TM-X-2890; E-7504) Avail: NTIS HC $2.75 CSCL 18G

Fission-gas-release rates from two 93 percent dense UN specimens were measured using a sweep gas facility. Specimen burnup rates averaged .0045 and .0032 percent/hr, and the specimen temperatures ranged from 425 to 1323 K and from 552 to 1502 K, respectively. Burnups up to 7.8 percent were achieved. Fission-gas-release rates first decreased then increased with burnup. Extensive interconnected intergranular porosity formed in the specimen operated at over 1500 K. Release rate variation with both burnup and temperature agreed with previous irradiation test results. Author

N73-32531*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A FISSION GAS RELEASE CORRELATION FOR URANIUM NITRIDE FUEL PINS
Michael B. Weinstein and Harry W. Davison Washington Oct. 1973 57 p refs
(NASA-TN-D-7401; E-7498) Avail: NTIS HC $3.50 CSCL 18J

A model was developed to predict fission gas releases from UN fuel pins clad with various materials. The model was correlated with total release data obtained by different experimentors, over a range of fuel temperatures primarily between 1250 and 1660 K, and fuel burnups up to 4.6 percent. In the model, fission gas is transported by diffusion mechanisms to the grain boundaries where the volume grows and eventually interconnects with the outside surface of the fuel. The within grain diffusion coefficients are found from fission gas release rate data obtained using a sweep gas facility. Author.

N73-32532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REACTIVITY CHANGE IN A FAST-SPECTRUM SPACE POWER REACTOR DUE TO A 328-METER-PER-SECOND (1075-FT/SEC) IMPACT
John A. Peoples, Jr. and Richard L. Puthoff Washington Oct. 1973 21 p refs
(NASA-TM-X-2886; E-7481) Avail: NTIS HC $2.75 CSCL 18I

Application of nuclear reactors in space will present operational problems. One such problem is the possibility of an earth impact at velocities in excess of 305 m/sec (1000 ft/sec). This

report shows the results of an impact against concrete at 328 m/sec (1075 ft/sec) and examines the deformed core to estimate the range of activity inserted as a result of the impact. The results of this examination are that the deformation of the reactor core within the containment vessel left only an estimated 2.7 percent void in the core and that the reactivity inserted due to this impact deformation could be from 4.0 to 10.25 dollars.
Author

N73-32533*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MOVABLE-MOLYBDENUM-REFLECTOR REACTIVITY EXPERIMENTS FOR CONTROL STUDIES OF COMPACT SPACE POWER REACTOR CONCEPTS
Thomas A. Fox Washington Oct. 1973 26 p refs
(NASA-TM-X-2922; E-7514) Avail: NTIS HC $3.00 CSCL 18I

An experimental reflector reactivity study was made with a compact cylindrical reactor using a uranyl fluoride - water fuel solution. The reactor was axially unreflected and radially reflected with segments of molybdenum. The reflector segments were displaced incrementally in both the axial and radial dimensions, and the shutdown of each configuration was measured by using the pulsed-neutron source technique. The reactivity effects for axial and radial displacement of reflector segments are tabulated separately and compared. The experiments provide data for control-system studies of compact-space-power-reactor concepts.
Author

N73-32534# Naval Research Lab., Washington, D.C.
FUNDAMENTAL REQUIREMENTS OF A FUSION FEASIBILITY EXPERIMENT BASED ON FLUX COMPRESSION BY A COLLAPSING LINER
Anthony E. Robson Jul. 1973 27 p refs
(RR0110941)
(AD-765314; NRL-MR-2616) Avail: NTIS CSCL 18/1

The criteria for fusion feasibility experiment based on the LINUS principle are derived. The dynamics of an infinitely long system with a perfectly conducting, incompressible liner are computed exactly, and the effects of liner resistivity, liner compressibility, and plasma end losses are treated as first-order corrections. The minimum energy requirement for such an experiment is derived.
Author (GRA)

N73-32535# Avco-Everett Research Lab., Everett, Mass.
EMISSION AND DEPOSITION OF CHARGE EXCHANGE ENERGY IN A HIGH ALTITUDE NUCLEAR EXPLOSION. VOLUME 1. DIFFUSION OF DEBRIS AIR PARTICLES IN AN EXPONENTIAL ATMOSPHERE Final Technical Report
Mar. 1973 54 p refs
(Contract DASA01-71-C-0046)
(AD-764955; DNA-3106F-1) Avail: NTIS CSCL 18/3

The report studies the distribution in the ionosphere of debris particles that have escaped a fireball through charge exchange collisions. At altitudes where the mean free paths for ionization and charge exchange, (lambda sub i) - (lambda sub cx), respectively, are much smaller than the scale height h of the atmosphere, the particles simply diffuse around their guiding streamlines. To account for this spreading, a diffusion equation with an altitude-dependent diffusion coefficient is derived and solved. It is shown how this result may be extended to regimes where (lambda sub j) /h < or = 1 (j = i, cx) no longer pertains, i.e., to higher altitudes where a diffusion approximation is invalid. A simple extension of the theory is possible only when r, the ratio of charge exchange to ionization cross section, is less than unity. When r = or > = 1, particles will spread significantly on their first charge exchange collision in a region where the diffusion theory is not applicable, and accurate account has to be taken of this initial non-diffusive spreading in order to obtain results in agreement with fact. A Monte-Carlo computer simulation was developed to corroborate the theory.
Author (GRA)

N73-32758 Joint Publications Research Service, Arlington, Va.
SYNTHESIS OF OPTIMAL CONTROL SYSTEMS FOR NUCLEAR POWER PLANTS AND POWER SUPPLIES ABOARD SPACECRAFT
V. A. Bodner, V. V. Bugrovskiy, S. S. Kaniovskiy, T. S. Martyanova, B. N. Petrov, Yu. A. Ryazanov, G. M. Ulanov, and A. A. Shevyakov *In its* Control in Space (JPRS-60179) 2 Oct. 1973 p 23-37 Transl. into ENGLISH of the book "Upravleniye v Kosmose" v. 2, Moscow, Izdatelstvo Nauka, 1972 p 277-288 (For availability see N73-32755 23-31)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-32536# Institut d'Aeronomie Spatiale de Belgique, Brussels.
LINE ABSORPTION BY LINES IN THE FUNDAMENTAL INFRARED BAND OF NITRIC OXIDE [ABSORPTION RAIE PAR RAIE DANS LA BANDE FONDAMENTALE INFRAROUGE DU MONOXYDE D'AZOTE]
S. Cieslik and C. Muller 1973 25 p refs In FRENCH; ENGLISH summary
(A-114-1973) Avail: NTIS HC $3.25

The strength of rotation-vibration lines in the fundamental band of nitric oxide is determined for its application to aeronomical analysis of the stratosphere.
Author

N73-32537*# Rochester Univ., N.Y. Inst. of Optics.
PROPERTIES OF MULTILAYER FILTERS Final Report, 1 Mar. 1967 - 28 Feb. 1973
P. W. Baumeister 28 Feb. 1973 23 p refs
(Grant NGL-33-019-003)
(NASA-CR-135671) Avail: NTIS HC $3.25 CSCL 20F

New methods were investigated of using optical interference coatings to produce bandpass filters for the spectral region 110 nm to 200 nm. The types of filter are: triple cavity metal dielectric filters; all dielectric reflection filters; and all dielectric Fabry Perot type filters. The latter two types use thorium fluoride and either cryolite films or magnesium fluoride films in the stacks. The optical properties of the thorium fluoride were also measured.
Author

N73-32538*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSMITTING AND REFLECTING DIFFUSER Patent Application
Lloyd S. Keafer, Jr., Ernest E. Burcher, and Leonard P. Kopia, inventors (to NASA) Filed 18 Jun. 1973 11 p
(NASA-Case-LAR-10385-3; US-Patent-Appl-SN-370999) Avail: NTIS HC $3.00 CSCL 20F

A method for constructing a near Lambertian diffuser of ultraviolet light is shown. An ultraviolet grade fused silica substrate is coated with vaporized fused silica. The coating thickness is controlled, one thickness causing ultraviolet light to diffuse and another thickness causing ultraviolet light to reflect a near Lambertian pattern.
NASA

N73-32539*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
ON THE MEASUREMENT OF RAYLEIGH SCATTERING BY GASES AT 6328A
Shardanand and Shashi K. Gupta Washington Oct. 1973 22 p refs
(NASA-TN-D-7442) Avail: NTIS HC $2.75 CSCL 07D

The problem of laboratory measurements of Rayleigh scattering and depolarization ratio for atoms and molecules in the gaseous state is described. It is shown that, if the scattered radiation measurements are made at two angles, the normal depolarization ratio cannot be determined meaningfully. However, from scattering measurements, the Rayleigh scattering cross sections can be determined accurately. The measurements of Raleigh scattering from He, H2, Ar, O2, and N2 for unpolarized radiation at 6328A are reported and compared with similar measurements at 6943 and 1215.7A.
Author

N73-32540*# Pennsylvania State Univ., University Park.
THE DESIGN AND DEVELOPMENT OF AN AUTOMATIC CONTROL SYSTEM FOR THE IN-DUCT CANCELLATION OF

SPINNING MODES OF SOUND M.S. Thesis
Walter W. Harrington Jun. 1973 249 p refs
(Grant NGL-39-009-121)
(NASA-CR-132317) Avail: NTIS HC $14.50 CSCL 20A

The reduction is discussed of the discrete tones generated by jet engines which is essential for jet aircraft to meet present and proposed noise standards. The discrete tones generated by the blades and vanes propagate in the inlet and exhaust duct in the form of spiraling acoustic waves, or spinning modes. The reduction of these spinning modes by the cancellation effect of the combination of two acoustic fields was investigated. The spinning mode synthesizer provided the means for effective study of this noise reduction scheme. Two sets of electrical-acoustical transducers located in an equally-spaced circular array simultaneously generate a specified spinning mode and the cancelling mode. Analysis of the wave equation for the synthesizer established the optimum cancelling array acoustic parameters for maximum sound pressure level reduction. The parameter dependence of the frequency ranges of propagation of single, specified circumferential modes generated by a single array, and of effective cancellation of the modes generated by two arrays, was determined. Substantial sound pressure level reduction was obtained for modes within these limits. Author

N73-32541*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENERGY STORAGE IN SOLID HELIUM
Jonas S. Zmuidzinas 15 Sep. 1973 14 p refs
(Contract NAS7-100)
(NASA-CR-135716; JPL-TM-33-653) Avail: NTIS HC $3.00 CSCL 20L

The problem of storing large amounts of energy in electronically excited solid helium, briefly He-4, is discussed. Important physical processes in He-4 are identified, and a study program is proposed with the aim of making energy storage in He-4 a practical reality. Author

N73-32542*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROTECTION OF MOISTURE SENSITIVE OPTICAL COMPONENTS Patent Application
John R. Hollahan and Theodore Wydeven, inventors (to NASA) Filed 2 Oct. 1973 11 p
(NASA-Case-ARC-10749-1; US-Patent-Appl-SN-402866) Avail: NTIS HC $3.00 CSCL 20F

Optical windows which are used in infrared spectroscopy, such as sodium chloride or cesium iodide, are protected by plasma deposition of a polymer thereon such as polychlorotrifluoroethylene. The polymer coating protects the window from attack by moisture and, in many instances, has the added advantage of acting as an anti-reflective coating so that transmission is increased in nearly all regions of the IR spectrum. NASA

N73-32543# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antriebe.
SOME EXPERIMENTS ON THE NOISE EMISSION OF COAXIAL JETS
Helmut W. Dahlen 23 Jun. 1972 18 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $3.00

The noise emission of coaxial jets or the reduction of jet noise by surrounding a circular primary jet with an annular flow is discussed. Acoustic experiments have been performed with a model hot primary jet which had a Mach number very close to one surrounded by a secondary cold annular flow of variable velocity and area ratios of the coplanar convergent nozzles. The experiments show that the reduction of high frequency noise emission depends on secondary flow velocity. In most cases this reduction seems to be not compensated by an increase in low frequency noise power. The small reduction in the total emitted noise power is uprated by weighting for perceived noise, so that the effects are not more negligible in view of the noise control of jet engines with fair by-pass ratios for SST and military aircraft. Author

N73-32544# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF LIGHT BEAM DEFLECTION BY LIGHT BEAM ULTRASONIC WAVE INTERACTION (BRILLOUIN EFFECT) Final Report [ETUDE DE LA DEVIATION D'UN FAISCEAU LUMINEUX PAR INTERACTION DE CE FAISCEAU ET D'UNE ONDE ULTRA-SONORE (EFFECT BRILLOUIN) RAPPORT FINAL]
R. Torguet 17 Dec. 1971 70 p In FRENCH
(Contract DGRST-70-72285)
(Rept-4.473) Avail: NTIS HC $5.50

Manufacturing procedures for massive lithium niobate ultrasonic wave transducers, indium vacuum welded on lead molybdate substrate, are described. The coupling efficiency varies between 35% and 70% depending on the required deviation in the frequency range from 150 MHz to 300 MHz with a mean VWSR value of 2 for homogeneous transducers of surfaces 6 to 10 sq mm. A theoretical and experimental study of thermal flow problems is given. A 500 points deflector was built with a point separation criterion of 3 db and a power requirement of one watt. Such a deflector was used in a television experiment requiring sweep speeds of less than 50 microseconds. Other deflectors built with a lower definition show that reproducibility problems are solved with a manufacturing success ratio of 50%. ESRO

N73-32545# Defence Research Information Centre, Orpington (England).
ON THE EFFECTS OF MOLECULAR INTERACTION ON THE SPECTRAL TRANSPARENCY OF INFRARED ACTIVE GASES
G. Germershausen, H. Luther et al Jun. 1973 23 p Transl. into ENGLISH from Ber. der Bunsenges., West Ger. v. 67, no. 2, 1963 p 205-212
(DRIC-Trans-3227) Avail: NTIS HC $3.25

The effect of a foreign gas on the extinction coefficient of an absorbent gas, resulting in pressure broadening with a definite gap width, is dealt with. Also studied are the line broadening and effect of the foreign gas on the population of the states of absorbent gas which take part in the energy transfer through absorption. ESRO

N73-32546# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TDAR (TELESCOPIC DETECTION AND RANGING): PRELIMINARY ORBIT DETERMINATION
Ramaswamy Sridharan 2 Jul. 1973 66 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-764727; TN-1973-28; ESD-TR-73-180) Avail: NTIS CSCL 17/8

The note analyzes the procedures for preliminary orbit determination based on sparse data from the TDAR system error analyses of the initial orbit generation in the case of the single-telescope and parallax schemes are performed. A model for the angular error in prediction based on the initial orbit is set up and used as a means of comparison of the two schemes. Author (GRA)

N73-32547# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HOLOGRAPHIC INVESTIGATION OF THERMAL EFFECTS IN NONLINEAR CRYSTALS M.S. Thesis
Kirby H. Williams Jun. 1973 98 p refs
(AD-764703; GEP/PH/73-23) Avail: NTIS CSCL 20/6

The thermal response of barium sodium niobate (BSN) and cesium dihydrogen arsenate (CDA) to intra-cavity, Nd:YALO3 laser radiation were studied using holographic interferometry. The laser operated at 1.08 micrometer at an internal power level of 8W. BSN showed a uniform increase of 2.6C for CW operation without harmonic generation and about 3.1C for Q-switched operation with harmonic generation. The increased response is believed to be a result of nonlinear absorption at the high peak powers associated with Q-switching. CDA, tested only under CW operation without harmonic generation, showed a gradient of 30C/cm in the beam spot and a logarithmic decrease across the bulk of the crystal. Thermal focussing by CDA and its effect on laser operation were observed; a thermal focal length of 46.5 cm was calculated. Thermal conductivities, phase match temperatures, and refractive index variations with temperature

were determined. Also, a second harmonic generation test was conducted for BSN: conversion efficiency of 0.2% in CW mode and 5% in Q-switched mode were determined from output power measurements. Author (GRA)

N73-32548# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE PRODUCTION AND EVALUATION OF HOLOGRAPHIC LENSES M.S. Thesis
Rickey Charles Seid Jun. 1973 89 p refs
(AD-764701; GEP/PH/73-19) Avail: NTIS CSCL 20/6

An experimental study was made to determine the optimum procedure for making both reflection and transmission bleached holographic lenses on Kodak's 649-F plates. Several bleaches were used, with the highest efficiencies (40%) occurring for the transmission lenses. The imaging ability of these lenses was determined by imaging an Air Force Resolution Chart through each lens and recording this image on 649-F plates. These plates were then scanned with a microdensitometer to determine the square wave modulation response of the lenses. Their performance dropped significantly when the spatial coherence of the reconstructing beam was reduced by placing a ground glass diffuser behind the resolution slide. The low order aberrations inherent in holographic lenses were largely compensated for by rotating the object or image plane about an axis perpendicular to the plane formed by the principal axes of the holographic lens. The transmission lenses were markedly better than the reflection lenses, with their maximum modulation response being 80% and best resolution at the object of 70 lines/mm.
Author (GRA)

N73-32549# Air Force Academy, Colo. Frank J. Seiler Research Lab.
FRICTION EFFECTS ON INERTIA COMPENSATORS USED FOR HELIOSTAT BASE MOTION ISOLATION
Gary C. Comfort Jun. 1973 12 p refs
(AF Proj. 7904)
(AD-764706; SRL-TR-73-0007) Avail: NTIS CSCL 17/8

The base motion isolation of an optical beam deflector with a two-axis gimbal support (heliostat) is discussed. The use of an auxiliary inertia coupled between the elevation gimbal and the heliostat mirror to produce a compensating torque upon the mirror is examined in detail. Two types of such inertia compensators, referred to as a gear compensator and a belt compensator are presented. The direction isolation from base motion are determined. The effect of Coulomb friction on the compensator action of a gear compensator is evaluated. Such friction-produced pointing error is shown to be reduced by the use of a combined inertia compensator utilizing both the belt and gear compensators simultaneously. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-32550*# Scientific Translation Service, Santa Barbara, Calif.
EFFECTIVE CROSS SECTIONS FOR COLLISION PROCESSES BETWEEN MOLECULAR OXYGEN AND SLOW ELECTRONS
Kazuo Takayanagi and Tan Takahashi Washington NASA Sep. 1973 41 p refs Transl. into ENGLISH from Bull. of the Inst. of Space and Aeron. Sci., Tokyo Univ., v. 3, no. 3, Jul. 1967 p 521-547
(Contract NASw-2483)
(NASA-TT-F-15048) Avail: NTIS HC $4.25 CSCL 20H

A continuation of previous work on N2 is presented. Available cross section data are reviewed for collisions processing between molecular oxygen and electron with the collision energy below 100 eV. Elastic scattering, attachment, rotational and vibrational transitions, electronic excitation and ionization are considered. The experimental generalized oscillator strengths reported by Lassettre and his collaborators are used to calculate the Born cross section for some electronic excitation and ionization processes. Author

N73-32551*# Science Applications, Inc., Huntsville, Ala.
METHODS OF TREATING COMPLEX SPACE VEHICLE GEOMETRY FOR CHARGED PARTICLE RADIATION TRANSPORT Final Report
C. W. Hill Aug. 1973 95 p refs
(Contract NAS8-28177)
(NASA-CR-124403; SAI-74-549-HU) Avail: NTIS HC $6.75 CSCL 20H

Current methods of treating complex geometry models for space radiation transport calculations are reviewed. The geometric techniques used in three computer codes are outlined. Evaluations of geometric capability and speed are provided for these codes. Although no code development work is included several suggestions for significantly improving complex geometry codes are offered. Author

N73-32552*# Brown Univ., Providence, R.I.
NON-LORENTZIAN ION CYCLOTRON RESONANCE LINE SHAPES ARISING FROM VELOCITY-DEPENDENT ION-NEUTRAL COLLISION FREQUENCIES
J. H. Whealton and E. A. Mason [1973] 11 p refs
(Grant NGL-40-002-059)
(NASA-CR-135724) Avail: NTIS HC $3.00 CSCL 20H

An asymptotic solution of the Boltzmann equation is developed for ICR absorption, without restrictions on the ion-neutral collision frequency or mass ratio. Velocity dependence of the collision frequency causes deviations from Lorentzian line shape. Author

N73-32553*# Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.
BACKGROUND OF THE COMPLETED RESEARCH; RELEVANCES TO SOLAR PHYSICS Final Technical Report, Sep. 1973
Ivan A. Sellin Sep. 1973 15 p refs
(Grant NGR-42-001-114)
(NASA-CR-135704) Avail: NTIS HC $3.00 CSCL 20H

Research activities reported consider the atomic structures of highly stripped heavy ions and their modes of formation and destruction in collisions. The lifetime of the metastable 2 3p1 state of the two electron ion F-7(+) was determined by measuring the radiative decay of an excited helium-like fluorine beam. Metastable state quenching measurements were performed on a helium-like ion to obtain the 1 1S0 to 2 3p2 transition probability. Exponential exchange state dependence of X-ray production cross sections was studied in heavy target atoms during collisions with light charged particles. G.G.

N73-32554*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF NUCLEAR RADIATION ON A HIGH-RELIABILITY SILICON POWER DIODE. 4: ANALYSIS OF REVERSE BIAS CHARACTERISTICS
Julian F. Been Washington Oct. 1973 36 p refs
(NASA-TN-D-7423; E-7362) Avail: NTIS HC $3.00 CSCL 09A

The effects of nuclear radiation on the reverse bias electrical characteristics of one hundred silicon power diodes were investigated. On a percentage basis, the changes in reverse currents were large but, due to very low initial values, this electrical characteristic was not the limiting factor in use of these diodes. These changes were interpreted in terms of decreasing minority carrier lifetimes as related to generation-recombination currents. The magnitudes of reverse voltage breakdown were unaffected by irradiation. Author

N73-32555# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
INTERACTIONS OF VERY ENERGETIC CHARGED PARTICLES WITH MATTER Final Report, 18 Jan. 1972 - 16 Jan. 1973
Peter J. McNulty 16 Apr. 1973 31 p refs
(Contract F19628-72-C-0209; AF Proj. 8600)
(AD-764833; AFCRL-TR-73-0143) Avail: NTIS CSCL 20/8

The work carried out under this contract involved investiga-

tions directed toward increasing our understanding of the high Z cosmic ray nuclei that arrive at the top of the earth's atmosphere. Reported on are experiments involving nuclear interactions of high energy neon nuclei in emulsion, particle induced visual sensations and the ability of the Princeton Particle Accelerator to accelerate argon nuclei to relativistic velocities. Author (GRA)

N73-32556# Naval Research Lab., Washington, D.C.
TRANSPORT THEORY OF PENETRATION BY HEAVY IONS
Irwin Manning and Doran W. Padgett Aug. 1973 33 p refs (AD-765315; NRL-MR-2631) Avail: NTIS CSCL 20/8

The penetration of matter by a heavy-ion beam is considered from the standpoint of the Boltzmann transport equation. It is assumed that the target may be modelled as being amorphous. This approach is worked out in detail, using the Lindhard theory for atomic collisions, and extended to include the transport properties of recoil atoms. The ultimate aim is to use the power of modern high-speed computers to numerically solve the transport equation using realistic approximations. The connection with Landau-Vavilov theories is examined. The solution of the transport equation near the penetrating surface is discussed; this discussion can be the basis of a self-contained theory of surface phenomena. Some of the implications of the approach of this report, should it be successfully implemented, are mentioned. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-32557 Florida Univ., Gainesville.
ELECTRON GAS BEHAVIOR OF A WEAKLY IONIZED PLASMA JET WITH THE EFFECT OF AN ELECTRIC FIELD APPLIED IN THE BASE REGION Ph.D. Thesis
Kenneth G. Soderstrom 1972 168 p
Avail: Univ. Microfilms Order No. 73-15542

An experimental investigation was made of a subsonic, low pressure, electrically ionized plasma jet having a low degree of ionization. Experimental measurements were conducted using conventional gas dynamic probes and a Langmuir probe. Both argon and helium plasma jets were studied. Particular emphasis was focused on the determination of the effects of an applied potential, in the base region, on the behavior of the electron gas within the jet, and outside the jet throughout the quiescent region. Results of radial and axial electron density and temperature distributions are compared as a function of base plate potential. Equipotential data mapped throughout the quiescent region are compared as a function of base plate potential. Results of electron density distributions are compared to previous similar investgations, and discrepancies in axial electron density distributions are discussed. Dissert. Abstr.

N73-32558 Maryland Univ., College Park.
THEORETICAL AND NUMERICAL APPROACHES TO TURBULENCE DOMINATED THETA PINCHES Ph.D. Thesis
Paulett Eva Creyke Liewer 1972 197 p
Avail: Univ. Microfilms Order No. 73-17042

Magnetic pulse propagation in a turbulent plasma was studied both theoretically and numerically to better understand experiments such as the theta pinch. Analytic and numerical calculations were done on the generally neglected lower hybrid drift instabilities which showed these modes to be important in a number of magnetic pulse experiments. Theoretical predictions of average heating rates, resistivity and fluctuating field levels due to these instabilities agreed well with the experimental results in three such experiments. A set of fluid equations were derived which included the effects of turbulence due to the lower hybrid and other unstable modes self-consistently, through transport terms which depend on the unstable mode and which evolve in time as the macroscopic fluid variables evolve. These fluid equations were integrated numerically using a recently developed algorithm that eliminates some important numerical problems present in earlier codes. The code was tested and then applied to two theta pinch experiments where turbulence was thought to play a dominant role. Dissert. Abstr.

N73-32559 Maryland Univ., College Park.
PARAMETRIC EXCITATION OF ION-ACOUSTIC WAVES IN A FULLY IONIZED PLASMA Ph.D. Thesis
Takeru Ohe 1972 153 p
Avail: Univ. Microfilms Order No. 73-17043

The analysis of lumped parameter systems is being extended to the analysis of distributed-parameter systems such as laboratory plasmas. The equation for ion-acoustic waves, derived for an infinite plasma using the fluid model, is Fourier analyzed for a bounded plasma; it is assumed that the waves undergo total reflection at the boundaries. The temporal behavior of the eigenmodes is described by the Mathieu equation, in which a time periodic coefficient is used to represent the periodic variation of the electron temperature. Dissert. Abstr.

N73-32560 Maryland Univ., College Park.
A STUDY OF TURBULENT SPECTRA IN A COLLISIONLESS PLASMA BY CO2 LASER SCATTERING Ph.D. Thesis
Norton Lee Bretz 1972 83 p
Avail: Univ. Microfilms Order No. 73-17030

Turbulence in a collisionless super-Alfvenic disturbance in a helium plasma is investigated using laser scattering and helium satellite spectroscopy. The electron temperature and density are measured by ruby laser scattering and it is found that the plasma is made up of a hot component whose temperature is about 200 ev. and a cold component whose temperature is less than 10 ev. The electron density fluctuation spectrum is measured for values of the plasma propagation vector somewhat less than the inverse Debye length. Scattered signals are observed in the current sheet which are larger by 10,000 than the incoherent scattering expected from a stationary plasma with the same temperature and density. Dissert. Abstr.

N73-32561 Rochester Univ., N.Y.
NONLINEAR THEORY OF THE MIRROR FLUTE INSTABILITY Ph.D. Thesis
Cheng-I Weng 1972 95 p
Avail: Univ. Microfilms Order No. 73-14839

The nonlinear small-amplitude behavior of a collisionless plasma is studied at the mirror flute instability threshold. A treatment assuming a constant gravity model of the mirror field predicts saturation of the m = 1 mode amplitude in disagreement with experiment. A model using nonconstant gravity yields the previous threshold mode and an upper damped mode. Nonlinear analysis shows the upper mode to be nonlinearly unstable. If the lower mode reaches sufficient amplitude it triggers the upper and is itself shut off. The resulting behavior is in general agreement with experiments. Dissert. Abstr.

N73-32562*# Stanford Univ., Calif. Inst. for Plasma Research.
LOW-FREQUENCY INSTABILITIES AND PLASMA TURBULENCE
Dragan B. Ilic Jul. 1973 143 p refs
(Grant NGL-05-020-176)
(NASA-CR-135669; SU-IPR-534) Avail: NTIS HC $9.25 CSCL 20I

A theoretical and experimental study is reported of steady-state and time-dependent characteristics of the positive column and the hollow cathode discharge (HCD). The steady state of a non-isothermal, cylindrical positive column in an axial magnetic field is described by three moment equations in the plasma approximation. Volume generation of electron-ion pairs by single-stage ionization, the presence of axial current, and collisions with neutrals are considered. The theory covers the range from the low pressure, collisionless regime to the intermediate pressure, collisional regime. It yields radial profiles of the charged particle velocities, density, potential, electron and ion temperatures, and demonstrates similarity laws for the positive column. The results are compared with two moment theories and with experimental data on He, Ar and Hg found in the literature for a wide range of pressures. A simple generalization of the isothermal theory for an infinitely long cylinder in an axial magnetic field to the case of a finite column with axial current flow is also demonstrated. Author

N73-32563# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

METHODS FOR CALCULATING ELECTRICAL CONDUCTIVITY COMPONENTS AND TOTAL RADIATION OF PLASMAS IN LOCAL THERMODYNAMIC EQUILIBRIUM

A. W. Neuberger 1973 119 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-51) Avail: NTIS HC $8.00; DFVLR Porz Wahn: 35,80 DM

The composition of a nitrogen plasma in local thermodynamic equilibrium at temperatures between 1000 K and 30,000 K and pressures between 0.05 atm and 100 atm is calculated. Using the obtained plasma composition, the electrical conductivity and the continuum radiation are determined. These are essentially in better agreement with known measurements, than the theoretical results. A semiempirical equation for the determination of the line radiation is derived. With it, also the calculation of the total radiation as a function of pressure and temperature is possible. Author

N73-32564# Institut Franco-Allemand de Recherches, St. Louis (France).

INFRARED DIAGNOSIS USING LIQUID CRYSTAL DETECTORS [INFRAROTDIAGNOSTIK MIT HILFE VON FLUESSIGKRISTALLDETEKTOREN]

M. Hugenschmidt and K. Vollrath Bonn Bundeswehramt 1973 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-73-16) Avail: NTIS HC $3.50; Bundeswehramt 25 DM

The possible uses of pulsed carbon dioxide lasers for analysis of plasmas and flows need appropriate infrared image converters. Emphasis was placed on liquid crystal detectors and their operational modes. Performance characteristics and selection criteria, such as high sensitivity, short reaction time, and high spatial resolution. ESRO

N73-32565# California Univ., Los Angeles. Plasma Physics Group.

PARAMETRIC INSTABILITIES OF ELECTROMAGNETIC WAVES IN PLASMAS

James F. Drake, Predhiman K. Kaw, Yee-Chun Lee, George Schmidt, Chuan S. Liu (Princeton Univ., N. J.), and Marshall N. Rosenbluth (Princeton Univ., N. J.) Jul. 1973 36 p refs

(Contract N00014-69-A-0200-4023)

(AD-764610; PPG-158) Avail: NTIS CSCL 20/9

A simple formalism for the parametric decay of an intense, coherent electromagnetic wave into an electrostatic wave and scattered electromagnetic waves in a homogeneous plasma is developed. Various instabilities including Brillouin and Raman backscattering, Compton scattering, filamentation and modulational instabilities are derived and discussed in a systematic manner. Growth rates as a function of the incident pump power are shown. Author (GRA)

N73-32566# California Univ., Los Angeles. Plasma Physics Group.

ABSOLUTE RAMAN SCATTERING INSTABILITIES IN AN INHOMOGENEOUS PLASMA

James F. Drake and Yee-Chun Lee Jul. 1973 42 p refs

(Contract N00014-69-A-0200-4023)

(AD-764611; PPG-156) Avail: NTIS CSCL 20/9

The authors derive the equations describing the decay of an intense, coherent EM wave into a scattered EM wave and a plasma wave in an inhomogeneous plasma. The plasma wave becomes nonpropagating in the vicinity of the cut-off of the scattered EM wave. The scattered EM waves can be trapped in the vicinity of their cut-offs and amplified by the pump. The growth rates of the resulting absolute instabilities are computed. These absolute instabilities may explain the strong heating and the blow-off observed in recent computer simulations in the vicinity of the cut-off of backscattered EM waves in Raman scattering. Author (GRA)

N73-32567# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

HIGH DENSITY PLASMA DYNAMICS Final Report, Jul. 1964 - Jun. 1973

Wolfgang G. Braun Jul. 1973 18 p refs

(AF Proj. 7073)

(AD-765221; ARL-73-0105) Avail: NTIS CSCL 20/9

A review of the author's research is presented with emphasis on the in-house work. The results contribute to plasma diagnostics and analysis by spectroscopic methods, understanding of the energy transport and exchange mechanisms in high density plasmas, and assessment of the deviations from local thermodynamic equilibrium in specific laboratory plasmas. For more detail, the reader is referred to the cited publications. (Modified author abstract) GRA

N73-32568# Naval Research Lab., Washington, D.C.

USE OF AN ELECTRON BEAM FOR PREIONIZATION IN THE Z-PINCH EXPERIMENT Interim Report

Edward Ott and Roswell Lee Jun. 1973 16 p refs

(NRL Proj. 77H02-28; RR011094I)

(AD-765313; NRL-MR-2591) Avail: NTIS CSCL 20/9

In the Z-pinch experiment a discharge of several mega-amps is initiated along a preionized filament in high density hydrogen gas. As presently proposed the preionized filament will be created by a high power laser focused in the gas. In the note the authors consider using an electron beam as an alternative to the laser system now used. It was found that a relativistic electron beam with very modest energy and current characteristic can produce a preionized column of plasma with the desired initial properties. Author (GRA)

N73-32569# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERACTION OF LASER PLASMA AND THE AIR

V. A. Arifov, M. R. Bedilov, T. G. Tsoi, and D. Kuramatov 30 Jul. 1973 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Uz. SSR (Tashkent), v. 29, no. 5, 1972 p 19-21

(AD-764936; FTD-HT-23-827-73) Avail: NTIS CSCL 20/9

The paper investigates the interaction of a plasma flow with the neutral gases of the air. GRA

N73-32570# Missouri Univ., Rolla. Dept. of Physics.

ELECTRICAL DISCHARGE METASTABLE DETECTOR Final Report

Beaufort M. Lancaster and Kaare J. Nygaard Jul. 1973 43 p refs

(Contract F33615-71-C-1314; AF Proj. 7073)

(AD-765210; ARL-73-0120) Avail: NTIS CSCL 07/4

Statistical time lags have been used to measure metastable densities in helium and helium-mercury afterglows with total pressures ranging from 0.2-100 torr. The simplest geometry employed was a parallel-plate discharge gap that was used for both the production and detection of the metastables. Better spatial resolution was obtained with the nude electrodes of a Nixie-tube inserted into the experimental volume. The sensitivity of the method is 10-100 metastables per cc. The experimental data have been compared with theoretical results based on diffusion of metastable atoms and molecules. The comparison is not good. Even so, due to its extremely high sensitivity, the method can be used to study processes of the second kind in flowing afterglows and laser plasma. Author (GRA)

N73-32839* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE ELECTRIC FIELD IN THE VICINITY OF A PHOTO-EMITTING PLATE IN A PLASMA

J. Barengoltz and C. Bauerle *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 26-32 refs (For availability see N73-32836 23-34)

CSCL 20I

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-32571* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF FABRICATING A TWISTED COMPOSITE SUPERCONDUCTOR Patent
Gerald V. Brown, Willard D. Coles, and James C. Laurence, inventors (to NASA) Issued 9 Oct. 1973 4 p Filed 16 Mar. 1972 Supersedes N72-20730 (10 - 11, p 1515)
(NASA-Case-LEW-11015; US-Patent-3,763,552; US-Patent-Appl-SN-235266; US-Patent-Class-29-599; US-Patent-Class-174-126CP; US-Patent-Class-174-DIG.6; US-Patent-Class-335-216) Avail: US Patent Office CSCL 20L

A method of producing a twisted, stabilized wire or tube superconductor which can be used to wind electromagnets, armatures, rotors, field windings for motors and generators, and other magnetic devices which use a solenoid, toroidal, or other type winding is reported. At least one groove is formed along the length of a wire substrate which is then twisted into a helix and a layer of intermetallic superconducting material is formed in the groove. This layer can be formed by depositing the desired intermetallic compound into the groove or by diffusing one component of the superconductor into the groove formed in a substrate composed of the other component. The superconductor prepared by this method comprises a non-superconductor wire twisted into the shape of a helix, having at least one groove containing a layer of superconductor material along the length of the wire. Official Gazette of the U.S. Patent Office

N73-32572 Purdue Univ., Lafayette, Ind.
AMORPHOUS BISMUTH-GERMANIUM THIN FILMS Ph.D. Thesis
Roger William Vass 1972 205 p
Avail: Univ. Microfilms Order No. 73-15880

Thin films of bismuth-germanium were fabricated by the method of co-deposit vapor quenching onto liquid nitrogen or water cooled substrates. Structural, electrical, optical and photoelectrical characterization of these films was accomplished. Some X-ray diffraction studies of the a Bi(x)Ge(1-x) thin films indicate an amorphous phase exists for a range of compositions. Direct current resistivity as a function of temperature from room temperature to 77 K shows that in the amorphous range the thin films are semiconducting with a continuously decreasing activation energy from room temperature to liquid nitrogen temperature. With an increase in bismuth concentration the range of activation energies decreases. The resistivity of the amorphous bismuth-germanium films decreases monotonically with increases in bismuth concentration. Optical reflectivity spectra in the ultraviolet-visible region show no crystalline structure and closely resemble the spectral reflectivity of amorphous germanium.
Dissert. Abstr.

N73-32573 Purdue Univ., Lafayette, Ind.
TRAVELING WAVE AMPLIFICATION IN SEMICONDUCTORS Ph.D. Thesis
Jon Conrad Freeman 1972 264 p
Avail: Univ. Microfilms Order No. 73-15805

A substantial interaction was obtained between slow circuit waves guided by meander lines and carrier waves in both Ge and InSb. The semiconductors were pulsed at low repetition rates and the microwave power passing through the meander-line was seen to increase during the pulse. The interactions were observed in the frequency range of 450 to 1050 MHz. Electronic gains of up to 40 db/cm were obtained with Ge at 4.2 K. Gains in the neighborhood of 15 db/cm at output power reference levels of several miliwatts were observed in Ge. The electronic gains observed for InSb were smaller, being about 2 db/cm. The InSb showed gain effects at both 77 K and 4.2 K, whereas the Ge only interacted at 4.2 K. Net gain with respect to the ports of the meander-line was not achieved due to the extremely large attenuation of the structure itself. For a well-matched structure, the attenuation through it was about 25 db. The nature of this high loss was discussed in detail.
Dissert. Abstr.

N73-32574 Nebraska Univ., Lincoln.
INVESTIGATIONS OF THE TEMPERATURE AND POLARIZATION DEPENDENCE OF THE OPTIMAL ABSORPTION EDGE OF GADOLINIUM MOLYBDATE Ph.D. Thesis
James Robert Zeidler 1972 191 p
Avail: Univ. Microfilms Order No. 73-15409

The optical absorption spectrum of gadolinium molybdate (GMO) was measured as a function of photon energy and polarization between 40 C and 205 C for absorption coefficients, alpha, between 10 and 300 cm /GMO undergoes a simultaneous ferroelectric-ferroelastic transition at 159 C; no discontinuity in the absorption spectrum was observed at this temperature. No differences were observed between spectra for light polarized along the a or b crystal axes, but the spectrum shifted to higher energy for light polarized along the c axis. The absorption spectra were parallel for polarization parallel and perpendicular to the c axis and shifted uniformly with temperature. Two absorption bands due to the two lowest energy internal transitions of the Gd(3+) ion were found to be superimposed on the interband absorption spectra. The measured absorption coefficients obey a modified Urbach rule, which, within experimental error, can be expressed as either of two equations. Dissert. Abstr.

N73-32575 Columbia Univ., New York.
ENERGY TRANSFER IN METHYL FLUORIDE Ph.D. Thesis
Eric Weitz 1972 138 p
Avail: Univ. Microfilms Order No. 73-16251

After pumping the Nu sub 3 mode of CH3F with a Q-switch CO2 laser, fluorescence was observed from the Nu sub 3 overtone, the Nu sub 3 + Nu sub 6 combination band and all fundamentals except Nu sub 3. The vibration-translation/rotation (V-T/R) relaxation rate has been measured for all observed states and is .59 m/sec/torr within experimental error. The deactivation of CH3F* by rare gases, H2, D2, O2, and N2 was measured and analyzed in the light of existing theories on V-T/R energy transfer. The results indicate that V-T processes dominate for light collision partners while V-R processes dominate for heavy collision partners. Energy transfer rates for transfer among modes of the molecule were measured for all fundamentals in CH3F except Nu sub 3. The fluorescence risetime of the 2 Nu sub 3 overtone and Nu sub 3 + Nu sub 6 combination band was also measured. All fundamentals and the 2 Nu sub 3 overtone equilibrate with the initial population disturbance in Nu sub 3 within 12 microsecs at 1 torr. Dissert. Abstr.

N73-32576 New Mexico Univ., Albuquerque.
DEVICE FABRICATION AND RADIATION EFFECTS STUDIES OF VARIOUS SEMICONDUCTORS Ph.D. Thesis
Tong-Won Kim 1972 213 p
Avail: Univ. Microfilms Order No. 73-16576

High mobility indium antimonide thin films were prepared using the electron beam evaporation technique to permit study of thin film structure and formation. Thin film Hall devices and magnetoresistors were fabricated, and electron and stable fast neutron radiation effects on InSb films were studied. Gallium arsenide phosphide (GaAsP) and silicon MIS capacitors were fabricated by using aluminum oxide (Al2O3) and silicon oxide (SiO sub x). Tellurium thin film transistors were also fabricated using electron beam evaporated Al2O3 or the anodization of aluminum. The device stability was studied before and after thermal annealing in different gases. Physical properties of InSb compound semiconductors were studied to gain understanding of the detailed mechanism of thin film nucleation and growth. It was found that larger grain size resulted in high mobility films. High mobility InSb thin films were prepared using the electron beam gun at a rate of 300 to 500 A/sec on precleaned glass substrates. Dissert. Abstr.

N73-32577 Purdue Univ., Lafayette, Ind.
ELASTIC CONSTANTS AND ELECTRICAL TRANSITION IN Ti2O3 AND V-DOPED Ti2O3 Ph.D. Thesis
Tsung-Chin Chi 1972 95 p
Avail: Univ. Microfilms Order No. 73-15783

Measurements have been made of the transit times of pulses of longitudinal and transverse ultrasonic waves in single-crystal samples of Ti2O3 and (Ti(1-x)Vx)2O3 having appropriate orientations at various temperatures between 77 K and 580 K. Sample length versus temperature data were also obtained using a dilatometer. The elastic constants of Ti2O3 deduced from our measurements are found to exhibit anomalies

connected with the gradual electrical transition which starts at about 400 K. Minima in C11, C33, and C12 and a maximum in C13 are accounted for semiquantitatively by means of a calculation of the contribution of Ti 3d electrons to the elastic constants using a deformation potential approach and two 3d subbands whose separation decreases drastically with increasing temperature and becomes negative above the electrical transition. Electron-electron and/or electron-phonon interactions may be involved implicitly via the strong dependence of the energy gap on temperature. Dissert. Abstr.

N73-32578 State Univ. of New York, Stony Brook.
THEORY OF SURFACE MOBILITY IN THE THERMALLY OXIDIZED SEMICONDUCTOR SURFACE INVERSION LAYERS AT ROOM TEMPERATURE Ph.D. Thesis
Ching-Yuan Wu 1972 75 p
Avail: Univ. Microfilms Order No. 73-15900

A theoretical calculation of the metal oxide semiconductor surface mobility at room temperature is presented. It is found that the three dimensional electron model, with specular surface scattering in the MOS inversion layer, fits the experimental data for channel mobility of typical MOS transistor at high surface electric field of high inversion layer carrier concentration quite well. Calculations based on diffuse surface scattering are also calculated and compared to experimental data for the specially treated MOS transistor of Fang and Triebwasser. It is again found that the theory agrees with the data for this transistor. The three dimensional electron model is justified by means of a calculation of the average thickness of the inversion layer. The theoretical calculations of the specular surface model are also extended to include the effect of substrate doping concentration, and bias on the surface mobility and inversion layer width. At high surface electric field or at high inversion layer electron density, it is found that the electron mobility is neither a pure function of surface electric field nor a pure function of inversion layer electron density, but a combination of the two.
Dissert. Abstr.

N73-32579 Purdue Univ., Lafayette, Ind.
A STUDY OF LATERAL DIFFUSION IN THIN FILM COUPLES OF GOLD AND SILVER Ph.D. Thesis
William Allen Watkins 1972 185 p
Avail: Univ. Microfilms Order No. 73-15885

An experimental deposition technique was developed to model a thin film couple after the standard bulk diffusion sandwich couple. The initial region of mixing between the two sides of the thin couple was less than 2 microns. Thin film couples of pure silver and gold annealed above 500 C, and at 416 C for times greater than 72 hours, exhibited dewetting on the pure gold side. For Ag-Au couplex annealed below 500 C and a zone of porosity occurred, increasing with time and temperature of anneal, leading to film separation near the pure silver side of the original region of mixing. The porosity formation was similar to that reported by investigators of bulk sandwich couples of pure Au and pure Ag. A model attributing the apparent diffusivity to transport along the film's grain boundaries was considered to be likely, if the grain boundaries could be assumed in a high state of disorder. Dissert. Abstr.

N73-32580 Pittsburgh Univ., Pa.
HYPERSONIC ATTENUATION IN SUPERCONDUCTORS Ph.D. Thesis
Jinwun Winston Lue 1972 71 p
Avail: Univ. Microfilms Order No. 73-16341

The effect of non-zero reduced phonon energy, on longitudinal hypersound attenuation was studied in superconducting aluminum and cadmium at frequencies of 9.2 to 9.3 GHz. Evidence of the quasiparticle creation process contribution (in addition to the usual quasiparticle scattering) is given by the characteristic temperature variation. A fairly sharp discontinuity and a steep but continuous attenuation are observed in the case of aluminum and cadmium, respectively. Both the discontinuity temperature in aluminum and the highest temperature of the steep variation interval in cadmium are significantly below Tc. Based on the BCS calculation, the attenuation data of aluminum was satisfactorily analyzed by a single energy gap, while that of cadmium to be fitted by assuming a continuously varying energy gap along the effective zone on the Fermi surface. In addition, a similar measurement on the ultrasonic attenuation in vanadium was made. No distinctive small s-gap effects were observed.
Dissert. Abstr.

N73-32581 Texas Technological Univ., Lubbock.
ULTRASONIC ATTENUATION IN SUPERCONDUCTING MOLYBDENUM Ph.D. Thesis
Stephen Guy OHara 1972 118 p
Avail: Univ. Microfilms Order No. 73-16279

Measurements were made of the ultrasonic attenuation of 10, 30, and 50 megahertz longitudinal sound waves in normal and superconducting high purity molybdenum single crystals. The measurements were made for ultrasound propagated in the (100),(110), and (111)crystallographic directions of molybdenum. The attenuation was measured as a function of the temperature from 1.10 to 0.38 Kelvin using a single-shot type He refrigerator. The data was taken with the aid of an ultrasonic transmitter-receiver system employing a sampling integrator and phase detection. This system greatly improved the signal to noise ratio in the detection of ultrasonic echoes. The measured ultrasonic attenuation was analyzed in terms of the Bardeen, Cooper, Schrieffer (BCS) theory of superconductivity. Good agreement has been found with the predictions of this theory for attenuation in the (100) and (111) directions in molybdenum. Data for the (100) direction indicated some deviation from a BCS single energy gap model. Dissert. Abstr.

N73-32582 Wisconsin Univ., Milwaukee.
THE BOSON METHOD IN SUPERCONDUCTIVITY Ph.D. Thesis
Ferdinando Mancini 1973 252 p
Avail: Univ. Microfilms Order No. 73-15739

A method of computation in quantum field theory is presented along with an illustration of its application to the study of superconducting systems. Also studied was the method's extension to temperature dependent situations and mixed state of type 2 superconductors. Dissert. Abstr.

N73-32583 Illinois Univ., Urbana.
PROTON CHANNELING IN SILVER SINGLE CRYSTALS AT VARIOUS TEMPERATURES Ph.D. Thesis
Ronald Richard Berliner 1973 251 p
Avail: Univ. Microfilms Order No. 73-17503

Channeling measurements were made on four silver single crystals at T = 300 K, T = 90 K and T = 20 K in the transmission configuration with 1 MeV protons. Effects due to temperature, crystal thickness, and crystal perfection were investigated through the use of large angle Rutherford scattering and small angle transmitted intensity and energy measurements. The majority of the results for the large angle (45 deg) Rutherford scattering agree with theory although the yield versus depth measurements are in poor agreement with previous results. The properties of the transmitted beam as measured near the beam axis are in qualitative agreement with theoretical expectations.
Dissert. Abstr.

N73-32584 Rochester Univ., N.Y.
A NETWORK MODEL OF ELECTRONIC STATES OF SOLID INTERFACES, SURFACE DEFECTS, PLANAR DEFECTS AND THIN FILMS Ph.D. Thesis
Cheng-Hsiao Wu 1973 181 p
Avail: Univ. Microfilms Order No. 73-14842

An investigation was made of some problems in solid state physics which can be solved exactly based on an electron network model. Briefly, an electron in the lattice is restricted to motion along one-dimensional lines joining adjacent atoms. The eigenvalue problem is thus reduced to the solution of a one-dimensional Schroedinger equation with appropriate boundary conditions at each lattice node. The electron energies fall into various permitted energy bands separated by forbidden energy values. The problems studied are solid interfaces, surface defects, planar defects, thin films and diatomic lattices. General formalism involved the solution of the appropriate node equations for each specific problem. These inhomogeneous node equations can be solved by the use of the method of Green's functions. Dissert. Abstr.

N73-32585 Purdue Univ., Lafayette, Ind.
A STUDY OF THE TRANSVERSE MAGNETO-RESISTANCE

AND HALL RESISTIVITY IN PURE CADMIUM AND IN DILUTE CRYSTAL ALLOYS OF Cd-Ag AND Cd-In Ph.D. Thesis
David Alan Lilly 1972 98 p
Avail: Univ. Microfilms Order No. 73-15828

The Hall resistivity and transverse magneto-resistance were measured on pure cadmium single crystals and on dilute crystal alloys of Cd-Ag and Cd-In in the temperature range 1.4K-30K and for field strengths from 1.7kG to 24kG. The residual resistance ratios of the pure samples varied from 16,000 to greater than 20,000, those of the alloys from 62 to approximately 20,000 (corresponding to controlled impurity concentrations from 500 ppmw to 1 ppmw). In the pure samples, RHO sub 21 (H,T) reversed sign for T < 5K, in agreement with previous published results on pure cadmium and a number of Cd-Zn crystal alloys, in which the behavior of RHO sub 21 (H,T) was semi-quantitatively described in terms of inter-sheet scattering. In the present alloys, at the lowest temperatures and highest fields, RHO sub 21 approaches a positive, constant value even for concentrations of Ag or In as low as 1 ppmw. It is shown that inter-sheet scattering cannot consistently account for this new behavior. Dissert. Abstr.

N73-32586 Iowa State Univ. of Science and Technology, Ames.
CRACK PROPAGATION VELOCITIES IN NaCl CRYSTALS Ph.D. Thesis
Donald Lee Hindman 1973 154 p
Avail: Univ. Microfilms Order No. 73-16957

Cleavage cracks with velocities ranging from about 600 cm/sec to about 160,000 cm/sec were produced in NaCl single crystals with a knife attached to a pendulum. The effects of several gases and of gamma irradiation on crack propagation were examined. Under conditions producing fast cracks (about 80,000 cm/sec), crack propagation in gamma irradiated specimens did not differ significantly from that in unirradiated specimens. The results of tests conducted in argon and nitrogen were similar. Crystals cleaved in carbon dioxide showed crack velocities significantly lower than for crystals cleaved in argon or nitrogen. The major effort of testing in air was an increase in the scatter of the data. With the aid of elementary beam theory a Lagrangian equation of motion was developed to relate the crack velocity to the cleavage energy. For a constant cleavage energy the equation predicts that the square of crack length is proportional to time when the crack is long with respect to transverse specimen dimensions. For shorter cracks, crack length is proportional to time. Dissert. Abstr.

N73-32587*# General Electric Co., Philadelphia, Pa. Space Div.
CRYSTAL GROWTH IN FUSED SOLVENT SYSTEMS Final Report
D. R. Ulrich, M. J. Noone, K. E. Spear, W. B. White, and E. C. Henry Jun. 1973 178 p refs
(Contract NAS8-28114)
(NASA-CR-124443) Avail: NTIS HC $11.00 CSCL 20B

Research is reported on the growth of electronic ceramic single crystals from solution for the future growth of crystals in a microgravity environment. Work included growth from fused or glass solvents and aqueous solutions. Topics discussed include: crystal identification and selection; aqueous solution growth of triglycine sulphate (TGS); and characterization of TGS. K.M.M.

N73-32588*# Texas Instruments, Inc., Dallas. Semiconductor Research and Development Labs.
GROWTH OF A SINGLE CRYSTAL RIBBON IN SPACE Final Report, 29 Jun. 1971 - 13 Apr. 1973
F. A. Padovani and F. W. Voltmer May 1973 45 p
(Contract NAS8-27807)
(NASA-CR-124439; Rept-03-72-121) Avail: NTIS HC $4.25 CSCL 20B

Three critical technological areas associated with adapting the method of pulling signal crystal silicon ribbon to a space environment were investigated. Basic parameters such as the magnitude of the forces required and the coupling between thermal and force are discussed. The design of a ribbon puller is described, and the problems encountered are also discussed. The force fields in the vicinity of a coil were characterized and results of attempts to pull ribbon are described. The results of the one experiment to grow a conventional float zone crystal in an external static magnetic field are presented. Author

N73-32589# Pennsylvania State Univ., University Park. Dept. of Physics.
THERMAL CONDUCTIVITY OF GERMANIUM IN THE BOUNDARY SCATTERING REGIME
George J. Campisi Jun. 1973 111 p refs
(Contract N00014-67-A-0385-0015)
(AD-764122; TR-10) Avail: NTIS CSCL 20/12

Thermal conductivity measurements were made on high purity single crystals of germanium. Measurements on sandblasted polished samples were made in the temperature range of 1 to 4.2 K where isotope and boundary scattering are present. For samples with rough surfaces, the measured conductivity showed a strong dependence on the orientation of the rod axis and the width of the sample. The direction dependence of the conductivity, a consequence of the elastic anisotropy, was demonstrated when a sample with a (100) rod axis had a measured conductivity at 1.5 K 45% higher than a sample with a (111) rod axis. A good fit to the measured conductivity data was obtained by using the Callaway theory that accounted for phonon-phonon scattering and for scattering from isotopic impurities and from rough ends and polished side surfaces. The Ziman theory of diffraction by surface irregularities in an infinitely long crystal was employed and it correctly predicted the temperature dependence of partial specular scattering. (Modified author abstract) GRA

N73-32590# Systems Science and Software, La Jolla, Calif.
THE DYNAMIC RESPONSE OF A SEMICONDUCTOR CONFIGURATION TO ELECTRON LOADING Final Report
K. G. Hamilton, J. W. Pritchett, and E. J. Halda Dec. 1972 168 p refs
(Contract DAAG39-71-C-0003)
(AD-763943; SSS-R-72-1410; HDL-003-3) Avail: NTIS CSCL 20/12

A two-dimensional elastic-plastic hydrodynamics code has been used to calculate the mechanical response of six axisymmetric semiconductor configurations to electron-beam loading. The grid response is displayed and discussed. The time variations of rear-surface velocities and displacements are shown at selected positions, while some rear-surface responses are exhibited as functions of radius at particular times. These calculations were performed for the prediction of, and comparison with, experimental measurements made on specimens tested using an electron accelerator at Harry Diamond Laboratories. Author (GRA)

N73-32591# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
ANOMALOUS TUNNELING CHARACTERISTICS
M. H. Frommer, M. L. A. MacVicar, and R. M. Rose 14 Aug. 1973 15 p refs
(Contract N00014-67-A-0204-0041)
(AD-764905; TR-8) Avail: NTIS CSCL 20/12

Quasiparticle tunneling into superconducting transition metals often show current-voltage characteristics differing from the ideal curves there being an excess current peak or knee occurring at biases near the sum of the half energy gaps of the two superconducting electrodes. In the present work evidence is given that this knee is probably caused by excess adsorbed oxygen in the oxide insulating barrier. Using bulk niobium single crystals, a knee is observed in the I-V characteristic, although of much smaller size than previously reported. GRA

N73-32592# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
UNUSUAL PHASE TRANSITION BEHAVIOR IN WEAKLY INTERACTING MAGNETIC CLUSTER SUBSTANCES: APPLICATION TO MAGNETIC COOLING
Jill C. Bonner and Simeon A. Friedberg 16 Jul. 1973 13 p refs
(Contract N00014-67-A-0314-0006; NR Proj. 018-301)
(AD-764620; TR-10) Avail: NTIS CSCL 20/12

The statistical mechanics of a variety of magnetic cluster substances is discussed, with particular reference to the effects of weak inter-cluster interactions. It is shown that in the case

of clusters with an energy gap between the singlet ground state and the excited states an unusual high-field transition may occur. The uses of cluster materials of this and related types in antiferromagnetic cooling by adiabatic magnetization are noted. A novel and more powerful method of cooling by adiabatic demagnetization of antiferromagnets is presented. Author (GRA)

N73-32593# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Electronics.
RARE EARTH ORTHOFERRITES-MICROMAGNETIC INTERACTIONS Final Scientific Report, 1 Jun. 1972 - 28 Feb. 1973
Shmuel Shtrikman and David Treves 30 Apr. 1973 15 p refs
(Grant AF-AFOSR-2327-72; AF Proj. 7367)
(AD-764826; AFML-TR-73-164) Avail: NTIS CSCL 20/12
The report includes topics such as magnetic phase transitions, magnetic susceptibilities, magneto-optic effect, Zeeman effect, structure and properties of ferrites, magnetic movements, and structure and properties of chromites. GRA

N73-32594# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
ON THE ABSENCE OF AN S-BAND ENERGY GAP IN NIOBIUM
M. H. Frommer, J. Bostock, Kofi Agyeman, R. M. Rose, and M. L. A. MacVicar 14 Aug. 1973 13 p refs
(Contract N00014-67-A-0204-0041)
(AD-764906; TR-9) Avail: NTIS CSCL 20/12
No evidence for a superconducting tunneling S-band energy gap in single crystal Nb has been observed for any of the main symmetry directions investigated in Nb/oxide/Pb(0.7)Bi(0.3) and Nb/oxide/In junctions. Author (GRA)

N73-32595# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
THE MAGNETIC PHASE TRANSITION IN FeCl3
Y. Endoh, J. Skalyo, Jr., W. T. Oosterhuis, and J. P. Stampfel Aug. 1973 4 p refs Sponsored in part by NSF and AEC
(Contract N00014-67-A-0314-0005; NR Proj. 018-304)
(AD-764982; TR-27) Avail: NTIS CSCL 20/12
Neutron scattering measurements on both polycrystalline and single crystalline FeCl3 were made near the phase transition at liquid helium temperatures. Magnetic scattering in the ordered state is found to be consistent with the spiral structure proposed by Cable et al., in which the wave vector of the spiral is parallel to (1,4,-5,0). The sublattice magnetization within the temperature range from 4.6K to 7.945K is described by (1-T/T(N) to the beta power with beta = 0.158 plus or minus 0.005 and T(N) = 8.060 plus or minus 0.005K, however at 7.98K the magnetization falls nearly to zero from about 50% of its saturation value and displays a hysteresis, thus indicating a first order transition. Critical scattering was observed which indicated a predominantly three dimensional character. (Modified author abstract) GRA

N73-32596# Pennsylvania Univ., Philadelphia. Dept. of Physics.
TEMPERATURE DEPENDENCE OF THE ELECTRIC FIELD GRADIENT YTTERBIUM IMPURITIES IN THULIUM METAL
Anne R. Chuhran-Long, Angela Li-Scholz, and Robert L. Rasera Jul. 1973 35 p refs
(Contract N00014-67-A-0216-0003)
(AD-764633; TR-2) Avail: NTIS CSCL 20/12
Time-differential perturbed angular correlations of nuclear gamma-rays from the decay of 172 Lu to 172 Yb have been used to measure the temperature dependence of the electric-quadrupole hyperfine interaction at dilute ytterbium impurities in polycrystalline thulium metal over the temperature range from 77 K to 560 K. (Modified author abstract) GRA

N73-32597# Pennsylvania Univ., Philadelphia. Dept. of Physics.
MOSSBAUER STUDY OF MAGNETIC STATES OF KFeF3 AND IMPLICATIONS FOR RbFeF3
Gerald R. Davidson, M. Eibschutz, and H. J. Guggenheim Jul. 1973 71 p refs Prepared in cooperation with Bell Telephone Labs., Inc., Murray Hill, N. J.
(Contract N00014-67-A-0216-0003)
(AD-764635; TR-4) Avail: NTIS CSCL 20/2
Mossbauer absorption spectra of Fe-57 in an unstrained single crystal platelet of KFeF3 have been measured between 297 and 4.2 K. The transition to the trigonal antiferromagnetic state occured at 112.5 + or - 0.5 K. The relaxation effects reported near T sub N in a previous study were absent, but spectra of a strained crystal provided evidence of strong magnetoelastic interactions. A transition to a lower symmetry, weak ferromagnetic phase was found at T sub R = 36.6 + or - 0.5 K. At 4.2 K the magnetic hyperfine field is 182.4 + or - 0.5 kOe, and the magnitude of the quadrupole splitting is 1.97 + or - 0.05 mm/sec. Analysis of the data in the antiferromagnetic phase indicates the spin alignment is parallel to the < 111 > distortion. The temperature dependence in this phase is compared with predictions of self-consistent molecular field theory calculations. Only fair agreement is found with the magnetically induced EFG model, which describes the Fe2(+) ion by a Hamiltonian incorporating free ion terms, cubic crystal field, and an exchange interaction. A substantially better fit is obtained with a second model which adds to this Hamiltonian an axial distortion term. Author (GRA)

N73-32598# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPIN-FLIP RAMAN SCATTERING IN CADMIUM SULFIDE M.S. Thesis
Terrence Franklin Deaton Jun. 1972 147 p refs
(AD-764699; GEP/PH/73-7) Avail: NTIS CSCL 20/12
Spin-flip Raman scattering from bound electrons in n-type CdS was observed at liquid helium temperature using the 4880 A and 5145 A lines of an Argon ion laser. Scattering was observed in Cd- or In-doped samples with carrier concentrations of 7 x 10 to the 16th power to 4 x 10 to the 18th power/cc. The g-factor was determined to be 1.77 plus or minus 0.04 for magnetic fields of 33 to 95 k. The linewidth measurements are consistent with a Lorentzian lineshape for the scattering. The relative Stokes and anti-Stokes intensities were measured at several field strengths, and the results indicate a spin temperature of 4.3K when the lattice is at liquid helium temperature. (Modified author abstract) GRA

N73-32599# New Mexico Univ., Albuquerque.
ELECTRON IMPACT, HEAT, AND TRANSPORT PHENOMENA IN SOLIDS
Martin Wolk and W. W. Grannemann Jul. 1973 265 p refs
(Contract N00014-68-A-0158)
(AD-764637; EE-205(73)ONR-005) Avail: NTIS CSCL 20/12
The theory of nonequilibrium transport processes is reviewed, generalized, and extended. The weakness of the heat equation is discussed, a generalized transport equation based on the Boltzmann equation is developed, and its validity in terms of the Liouville equation, the R-particle reduced distribution function, and the B-B-G-K-Y hierarchy is discussed in the framework of the Bogoliubov initial, kinetic, and hydrodynamic time regimes. Viscous hydrodynamic theory is reviewed and transport moment methods are generalized in phase space; the basic semiconductor equations with sources and sinks are derived from the transport moment equations. Drift and heat current densities are developed. Thermal and electrical conductivities are discussed. Nonequilibrium transport processes are discussed for solids subjected to electron bombardment for low dose irradiation and high energy-density pulsed beams. A formulation for electron beam bombardment in the diffusion approximation regime is developed. (Modified author abstract) GRA

N73-32600# California Univ., Irvine. Dept. of Physics.
LATTICE DYNAMICS OF CRYSTAL SURFACES
Richard F. Wallis Aug. 1973 201 p refs
(Contract N00014-69-A-0200-9003)
(AD-764644; TR-73-55) Avail: NTIS CSCL 20/12
The report is a review on surface effects in lattice dynamics. It is directed toward graduate students and research workers interested in the study of solid surfaces. Experimental and theoretical research activity directed toward a better understanding of surfaces has increased remarkably during the past few years. This review will be of interest to those concerned with the vibrational and electronic properties of solid surfaces, physical

electronics, surface wave devices, and catalysis. The article surveys advances in acoustical surface waves, optical surface waves, surface wave attenuation, the scattering of particles from solid surfaces, and the effect of surfaces on vibrational contributions to thermodynamic and optical properties. (Modified author abstract) GRA

N73-32601# North Carolina Univ., Chapel Hill.
RESEARCH ACTIVITIES IN THE FIELD OF MATERIALS SCIENCE Annual Technical Report, 1 Jun. 1972 - 31 May 1973
31 May 1973 121 p refs Sponsored in parts by ARPA and AFOSR
(Contract NSF GH-33632)
(AD-764819) Avail: NTIS CSCL 07/4

The report comprises brief summaries of materials research projects at the University of North Carolina at Chapel Hill for the year ending 31 May 1973. It contains brief reports of progress in the various research programs. They are arranged alphabetically by the name of the principal investigator. In cases where work has reached the publication stage, the abstract is often quoted. GRA

N73-32602# Pennsylvania Univ., Philadelphia. Dept. of Physics.
A MONTE CARLO METHOD FOR FITTING 57Fe MOSSBAUER SPECTRA
Gerald R. Davidson Jul. 1973 20 p refs Prepared in cooperation with Bell Telephone Labs., Inc., Murray Hill, N. J.
(Contract N00014-67-A-0216-0003)
(AD-764634; TR-3) Avail: NTIS CSCL 20/12

A convenient, systematic, and inexpensive procedure for determining values for the hyperfine parameters H(hf), delta E(Q), eta, theta, and psi consistent with a 57Fe Mossbauer spectrum is described. Only line position information is used in this procedure. H(hf) and /delta E(Q)/ are determined analytically, while values for the remaining parameters are found by use of a FORTRAN 4 Monte Carlo search program. Author (GRA)

N73-32603# Ceradyne, Inc., Chatsworth, Calif.
GROWTH OF KTN SINGLE CRYSTALS Final Report, Sep. 1968 - Dec. 1969
Jack A. Rubin May 1973 37 p refs
(Contract F19628-68-C-0396; AF Proj. 5620)
(AD-764902; AFCRL-TR-73-0334) Avail: NTIS CSCL 20/2

KTN is a single crystal ferroelectric of composition KTa(0.65) Nb(0.35)O3. KTN has a curie point near room temperature and exhibits a large quadratic electrooptic, i.e., Kerr effect. KTN is useful as a light beam modulator and deflector, microwave modulator, optical polarization switch, variable delay line, and parametric amplifier. Crystals as large as 50mm x 50mm x 10mm were grown. The crystals were pale blue when grown in Pt-3.5 Rh crucibles and colorless when grown in Pt crucibles. Oxygen, air, or argon atmospheres had no significant effect on the crystal color. KTN grown in this study contained large clear areas and were reproducible in quality, but still suffered from flux inclusions and striations. (Modified author abstract) GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-32604# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
PULSATING COMBUSTIBLE SOLID PROPELLANTS [PULSIEREND ABBRENNENDE FESTTREIBSTOFFE]
F.-W. Wasmann 31 Dec. 1972 35 p refs In GERMAN
(ICT-9/72) Avail: NTIS HC $3.75

Solid propellant systems were developed on the basis of mixed polymerizates and inorganic oxygen carriers, which combust with a periodically varying velocity, as opposed to normal solid propellants. The combustion velocity frequency of these pulsating systems may be varied in a range between 0.1 and 1000 Hz. The composition, manufacture, operation and properties of such solid propellants are described. The propellants are obtained by mixed polymerization of monomers containing nitrate groups with acrylic, and methacrylic acid esters containing dissolved inorganic perchlorates. Combustion frequency variation, obtained by changing the composition, may be used to simulate the unwanted oscillating combustion of solid rocket propellants. ESRO

N73-32605# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
PHYSICAL AND CHEMICAL PROPERTIES OF JP-4 JET FUEL FOR 1972
James R. McCoy Jun. 1973 119 p
(AF Proj. 3048)
(AD-764690; AFAPL-TR-73-15) Avail: NTIS CSCL 21/4

Test reports on 3610 samples of JP-4 fuel purchased in 1972 were analyzed to determine the average properties and distribution of values for eight geographical districts. As required by the JP-4 specification, MIL-T-5624H, 21 of the inspection tests were selected for analysis. Although since 1964, the API Gravity has gradually increased, no other significant trends were noted. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-32606* Radio Corp. of America, Princeton, N.J.
THERMAL FLUX TRANSFER SYSTEM Patent
Robert Alfred Freggens, inventor (to NASA) Issued 18 Sep. 1973 7 p Filed 16 Jun. 1971 Supersedes N72-20771 (10 - 11, p 1520) Sponsored by NASA
(NASA-Case-NPO-12070-1; US-Patent-3,759,443; US-Patent-Appl-SN-153542; US-Patent-Class-239-127.1; US-Patent-Class-60-267; US-Patent-Class-165-105; US-Patent-Class-165-141; US-Patent-Class-165-185) Avail: US Patent Office CSCL 21H

A thermal flux transfer system for use in maintaining the thrust chamber of an operative reaction motor at given temperatures is described. The system is characterized by an hermetically sealed chamber surrounding a thrust chamber to be cooled, with a plurality of parallel, longitudinally spaced, disk-shaped wick members formed of a metallic mesh and employed in delivering a working fluid, in its liquid state, radially toward the thrust chamber and delivering the working fluid, in its vapor state, away from the nozzle for effecting a cooling of the nozzle, in accordance with known principles of an operating heat pipe. Official Gazette of the U.S. Patent Office

N73-32607*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER IN A FISSIONING URANIUM PLASMA REACTOR CAVITY
Albert F. Kascak Washington Oct. 1973 23 p refs
(NASA-TM-X-2885; E-7525) Avail: NTIS HC $2.75 CSCL 20I

Two schemes are investigated by which a fission-heated uranium plasma located in the central cavity of a test reactor could be insulated to keep its temperature above condensation in a neutron flux of 10 to the 15th power neutrons/(sq cm)(sec) or less. The first scheme was to use a mirrored cavity wall to reflect the thermal radiation back into the plasma. The second scheme was to seed the transpirational cavity wall coolant so as to make it opaque to thermal radiation, thus insulating the hot plasma from the cold wall. The analysis showed that a mirrored cavity wall must have a reflectivity of over 95 percent or that seeded argon must be used as the wall coolant to give an acceptable operating margin above fuel condensation conditions. Author

N73-32608*# General Electric Co., Evendale, Ohio.
ACOUSTIC TESTING OF A SUPERSONIC TIP SPEED FAN WITH ACOUSTIC TREATMENT AND ROTOR CASTING SLOTS. QUIET ENGINE PROGRAM SCALE MODEL FAN C
S. B. Kazin Oct. 1973 98 p refs
(Contract NAS3-12430)
(NASA-CR-134501; R73AEG148) Avail: NTIS HC $7.00 CSCL 21E

Acoustic tests were conducted on a high tip speed (1550 ft/sec, 472.44 m/sec) single stage fan with varying amounts of wall acoustic treatment and with circumferential slots over the rotor blade tips. The slots were also tested with acoustic treatment placed behind the slots. The wall treatment results show that the inlet treatment is more effective at high fan speeds and aft duct treatment is more effective at low fan speeds. Maximum PNL's on a 200-foot (60.96 m) sideline show the untreated slots to have increased the rear radiated noise at approach. However, when the treatment was added to the slots inlet radiated noise was decreased, resulting in little change relative to the solid casing on an EPNL basis. Author

N73-32609*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE COMPARISON OF TWO 1.2-PRESSURE-RATIO FANS WITH 15 AND 42 ROTOR BLADES
Richard P. Woodward, Frederick W. Glaser, and Joseph A. Wazyniak Washington Oct. 1973 76 p refs
(NASA-TM-X-2891; E-7477) Avail: NTIS HC $3.75 CSCL 21E

Two 1.829-m-(6-ft-) diameter fans suitable for a quiet engine for future short-takeoff-and-landing (STOL) aircraft were compared. Both fans were designed for a 1.2 pressure ratio with similar weight flows, thrusts, and tip speeds. The first fan, designated QF-9, had 15 rotor blades and 11 stator blades. The rotor was highly loaded and the tip solidity was less than 1. The QF-9 rotor blades had an adjustable pitch feature which can be used for thrust reversal. The second fan, designated QF-6, operated at a moderate loading with a rotor tip solidity greater than 1. Fan QF-6 had 42 rotor blades and 50 stator blades. The low number of rotor blades for QF-9 reduced the frequency of the blade-passage tone below the range of maximum annoyance. In addition to this difference, the QF-9 fan had a somewhat smaller rotor-stator separation than the QF-6 fan. In terms of sound pressure level and sound power level, QF-9 was the noisier fan, with the power level results for QF-9 being about 1 db above those for QF-6 at equivalent operating points as determined by similar stage pressure ratios. At the same equivalent operating points, the maximum perceived noise along a 152.5-m (500-ft) sideline for QF-9 was about 2.5 PNdb below that for QF-6, which indicated that QF-9 was less objectionable to human hearing. Author

N73-32610*# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED TWO-STAGE COMPRESSOR PROGRAM DESIGN OF INLET STAGE
C. A. Bryce, C. J. Paine, A. R. S. McCutcheon, R. K. Tu, and G. L. Perrone Aug. 1973 301 p refs
(Contract NAS3-15324)
(NASA-CR-120943; AT-6133-R) Avail: NTIS HC $17.25 CSCL 21E

The aerodynamic design of an inlet stage for a two-stage, 10/1 pressure ratio, 2 lb/sec flow rate compressor is discussed. Initially a performance comparison was conducted for an axial, mixed flow and centrifugal second stage. A modified mixed flow configuration with tandem rotors and tandem stators was selected for the inlet stage. The term conical flow compressor was coined to describe a particular type of mixed flow compressor configuration which utilizes axial flow type blading and an increase in radius to increase the work input potential. Design details of the conical flow compressor are described. Author

N73-32611*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPUTTER EROSION AND DEPOSITION IN THE DISCHARGE CHAMBER OF A SMALL MERCURY ION THRUSTER
John L. Power 1973 41 p refs Presented at 10th Elec. Propulsion Conf., Lake Tahoe, Nev., 31 Oct. - 2 Nov. 1973; sponsored by AIAA
(NASA-TM-X-71424; E-7666) Avail: NTIS HC $4.25 CSCL 21C

A 5 cm diameter mercury ion thruster similar to one tested for 9715 hours was operated approximately 400 hrs each at discharge voltages of 36.6, 39.6, and 42.6 V, with corresponding discharge propellant utilizations of 58, 68, and 70 percent. The observed sputter erosion rates of the internal thruster parts and the anode weight gain rate all rose rapidly with discharge voltage and were roughly in the ratio of 1:3:5 for the three voltages. The combined weight loss of the internal thruster parts nearly balanced the anode weight gain. $Hg(+2)$ ion apparently caused most of the observed erosion. Author

N73-32612*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MIXING OF MULTIPLE DILUTION JETS WITH A HOT PRIMARY AIRSTREAM FOR GAS TURBINE COMBUSTORS
James D. Holdeman, R. E. Walker (Aerojet Liquid Rocket Co.), and D. L. Kors (Aerojet Liquid Rocket Co.) 1973 10 p refs Presented at the 9th Propulsion Conf., Las Vegas, Nevada, 5-7 Nov. 1973; sponsored by AIAA and SAE
(NASA-TM-X-71426; E-7667) Avail: NTIS CSCL 21E

The mixing of multiple air jets with a subsonic heated crossflow in a constant area duct was studied experimentally. The jet-to-mainstream momentum flux ratio was varied from 6 to 60. Temperature and pressure surveys were made at several downstream locations for orifice geometries with parametric variation of orifice size and spacing. A mixing efficiency parameter was defined which characterized the effectiveness of the mixing over the range of conditions examined. It was found that for a given momentum flux ratio, there exists a ratio of orifice spacing to duct height which provides the best mixing. Author

N73-32613*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ODOR INTENSITY AND CHARACTERIZATION STUDIES OF EXHAUST FROM A TURBOJET ENGINE COMBUSTOR
Helmut F. Butze and David A. Kendall 1973 12 p refs Presented at 9th Propulsion Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA and Soc. of Automotive Engr.
(NASA-TM-X-71429; E-7680) Avail: NTIS HC $3.00 CSCL 21E

Sensory odor tests of the exhaust from a turbojet combustor operating at simulated idle conditions were made by a human panel sniffing diluted exhaust gas. Simultaneously, samples of undiluted exhaust gas were collected on adsorbent substrates, subsequently removed by solvent flushing, and analyzed chemically by liquid chromatographic methods. The concentrations of the principal malodorous species, the aromatic (unburned fuel-related) and the oxygenated (partially burned fuel) fractions, as determined chromatographically, correlated well with the intensity of the odor as determined by sniffing. Odor intensity increased as combustion efficiency decreased. Combustor modifications which increased combustion efficiency decreased odor intensity. Author

N73-32614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECTS OF INLET TEMPERATURE AND PRESSURE DISTORTION ON TURBOJET PERFORMANCE
Willis M. Braithwaite, Edwin J. Graber, Jr., and Charles M. Mehalic 1973 16 p refs Presented at 9th Propulsion Joint Specialists Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA and Soc. of Automotive Engr.
(NASA-TM-X-71431; E-7302) Avail: NTIS HC $3.00 CSCL 21E

The effects on stability of steady-state, 180 degree extent circumferential distortions of inlet total temperature and pressure were experimentally determined for a turbojet engine. Results for both individual and combined temperature and pressure distortions are presented showing the losses incurred in stall pressure ratio and are compared with results predicted using a simplified parallel compressor model. The loss due to combined distortions was dependent upon the relative orientation between the low pressure and high temperature regions. Reasonable

agreement was achieved between the predicted and observed loss in stall pressure ratio when based on a constant corrected speed relationship. Author

N73-32615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDIES OF DISHED ACCELERATOR GRIDS FOR 30-CM ION THRUSTERS
Vincent K. Rawlin 1973 17 p refs Presented at 10th Elec. Propulsion Conf., Lake Tahoe, Nev., 31 Oct. - 2 Nov. 1973; Sponsored by AIAA
(NASA-TM-X-71420; E-7660) Avail: NTIS HC $3.00 CSCL 21C

Geometrically different sets of dished accelerator grids were tested on five 30-cm thrusters. The geometric variation of the grids included the grid-to-grid spacing, the screen and accelerator hole diameters and thicknesses, the screen and accelerator open area fractions, ratio of dish depth to the dish diameter, compensation, and aperture shape. In general, the data taken over a range of beam currents for each grid set included the minimum total accelerating voltage required to extract a given beam current and the minimum accelerator grid voltage required to prevent electron backstreaming. Author

N73-32616*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLASMA FLUCTUATIONS IN A KAUFMAN THRUSTER
John S. Serafini and Fred F. Terdan 1973 19 p refs Presented at 10th Elec. Propulsion Conf., Lake Tahoe, Nev., 31 Oct. - 2 Nov. 1973; sponsored by AIAA
(NASA-TM-X-71421; E-7663) Avail: NTIS HC $3.00 CSCL 21C

Measurements of the RMS magnitude, spectra, and cross correlations for the fluctuations in the beam, discharge, and neutralizer keeper currents are presented for a 30 cm diameter dished grid ion thruster for a range of magnetic baffle currents. The ratio of RMS to mean ion beam current varied from 0.04 to 0.23. The spectra of the amplitudes of the beam and discharge current fluctuations were taken up to 9 MHz and show that the predominant amplitudes occur at frequencies of 10 kHz or below. The falloff with increasing frequency is rapid. Frequencies above 100 kHz the spectral levels are 45 kb or more below the maximum peak amplitudes. The cross correlations revealed the ion beam fluctuations to have large radial and axial scales. Author

N73-32617*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF MERCURY THRUSTER ISOLATORS
Maris A. Mantenieks 1973 16 p refs Presented at the 10th Electric Propulsion Conference, Lake Tahoe, Nevada, 31 Oct. - 2 Nov. 1973; sponsored by AIAA
(NASA-TM-X-71422; E-7664) Avail: NTIS HC $3.00 CSCL 21C

Mercury ion thruster isolator lifetime tests were performed using different isolator materials and geometries. Tests were performed with and without the flow of mercury through the isolators in an oil diffusion pumped vacuum facility and cryogenically pumped bell jar. The onset of leakage current in isolators occurred in time intervals ranging from a few hours to many hundreds of hours. In all cases, surface contamination was responsible for the onset of leakage current and subsequent isolator failure. Rate of increase of leakage current and the leakage current level increased approximately exponentially with isolator temperature. Careful attention to shielding techniques and the elimination of sources of metal oxides appear to have eliminated isolator failures as a thruster life limiting mechanism. Author

N73-32618*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURRENT TECHNOLOGY IN ION AND ELECTROTHERMAL PROPULSION
Robert C. Finke and C. K. Murch (TRW Systems Group) 1973 20 p refs Proposed for presentation at 9th Prop. Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA and SAE
(NASA-TM-X-71434; E-7686) Avail: NTIS HC $3.00 CSCL 21C

High performance propulsion devices, such as electrostatic ion engines and electrothermal thrusters, are achieving wide user acceptance. The current technology and projected development trends in the areas of ion and electrothermal propulsion systems and components are surveyed. Author

N73-32619*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CENTAUR D-1T PROPULSION AND PROPELLANT SYSTEMS
William E. Goette 1973 11 p Presented at 9th Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA and SAE
(NASA-TM-X-71436; E-7691) Avail: NTIS HC $3.00 CSCL 21H

A description is presented of the propulsion and propellant systems of the Centaur D-1T, an improved version of the Centaur high energy upper state. The primary change to the propulsion system to provide three-burn capability was the addition of radiation shielding to the propellant duct. The redundant valves and feed paths were added to the H202 supply and reaction control system to increase system tolerance to the most probable causes of failure. Other changes were made to enhance mission capability of the Centaur, and represent an increase in inherent reliability of the vehicle through reduction of single failure points and by substitution of more reliable components. Author

N73-32620*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF NOISE CONSTRAINTS ON ENGINE CYCLE OPTIMIZATION FOR LONG-HAUL TRANSPORTS
Robert J. Antl 1973 11 p refs Presented at the 9th Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA and SAE
(NASA-TM-X-71447; E-7712) Avail: NTIS HC $3.00 CSCL 21A

Results are presented of NASA studies to determine optimum engine cycles for noise levels of 10, 15, and 20 EPNdb below current FAA regulations. The study aircraft were 200-passenger trijets flying over ranges of 5,556 and 10,200 km at cruise speeds of Mach 0.90 to 0.98. The economic impact of reducing noise, the identification of needed advanced technology and the effect of these advances are presented. The studies showed that the noise constraints imposed compromises on the optimum cycle with resulting economic penalties. The application of advanced engine technologies, however, could effectively offset these economic penalties. Author

N73-32621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEMONSTRATION OF A PULSING LIQUID HYDROGEN/LIQUID OXYGEN THRUSTER
P. N. Herr and L. Choenman (Aerojet Liquid Rocket Co.) 1973 17 p refs Presented at 9th Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by the Am. Inst. of Aeron. and Astronaut. and the Soc. of Automotive Engr.
(NASA-TM-X-71444; E-7703) Avail: NTIS HC $3.00 CSCL 21H

Successful operation of a pulsing liquid hydrogen/liquid oxygen attitude control propulsion system thruster (1250 lb sub f) at cryogenic inlet conditions while maintaining high specific impulse and low impulse bit capability was demonstrated. Significant technical advances and departures from conventional injector design practices were necessary in order to achieve an operable thruster. These advancements were achieved through extensive analyses of heat transfer and injector manifold priming that established the baseline feasibility for an actual hardware design. The primary subject of this paper is the result of experimental evaluation of the 45 R hydrogen inlet temperature injector concept. The test matrix consisted of 66 hot firing tests in a heat sink thrust chamber. Author

N73-32622*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRUST AND PUMPING CHARACTERISTICS OF CYLINDRICAL EJECTORS USING AFTERBURNING TURBOJET GAS GENERATOR
Nick E. Samanich and Sidney C. Huntley 1969 44 p refs
(NASA-TM-X-52565) Avail: NTIS HC $4.25 CSCL 21E

Static tests of cylindrical ejectors having ejector to primary diameter ratios from 1.1 to 1.6 and ejector length to primary nozzle diameter ratios from 0.9 to 2.1 are reported. Power setting of the J85-13 turbojet engine was varied from part power to maximum afterburning. Corrected secondary weight flow ratio was varied from 0.02 to 0.08 over a range of exhaust nozzle pressure ratios from 2.0 to 9.0. Secondary flow temperature rise and pressure drop characteristics through the nacelle secondary flow passage were also obtained. Author

N73-32623*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PERFORMANCE CHARACTERIZATION TESTS OF THREE 0.44-N (0.1-lbf) HYDRAZINE CATALYTIC THRUSTERS

P. I. Moynihan and R. A. Bjorklund 1 Sep. 1973 68 p refs (Contract NAS7-100)

(NASA-CR-135717; JPL-TR-32-1584) Avail: NTIS HC $5.50 CSCL 21H

The 0.44-N class of hydrazine catalytic thruster was evaluated at the Jet Propulsion Laboratory to assess its capability for spacecraft limit-cycle attitude control with thruster pulse durations on the order of 10 msec. Dynamic-environment and limit-cycle simulation tests were performed on three commercially available thruster/valve assemblies, purchased from three different manufacturers. The results indicate that this class of thruster can sustain a launch environment and, when properly temperature-conditioned, can perform limit-cycle operations over the anticipated life span of a multi-year mission. The minimum operating temperature for very short pulse durations was determined for each thruster. Pulsing life tests were then conducted on each thruster under a thermally controlled condition which maintained the catalyst bed at both a nominal 93 C and 205 C. These were the temperatures believed to be slightly below and very near the minimum recommended operating temperature, respectively. Author

N73-32624*# Santa Clara Univ., Calif.

REVERSED COWL FLAP INLET THRUST AUGMENTOR

Patent Application

Dah Yu Cheng, inventor (to NASA) Filed 17 Sep. 1973 18 p (Grant NGR-05-017-033)

(NASA-Case-ARC-10754-1; US-Patent-Appl-SN-398886) Avail: NTIS HC $3.00 CSCL 21E

An adjustable airfoil is described for varying the geometry of a jet inlet and an ejector inlet in a jet engine for providing thrust augmentation and noise reduction. The airfoil comprises essentially a plurality of segments which are extended radially outwardly and retracted relative to the longitudinal axis of the engine as a function of a change in the pressure differential between the upstream and downstream surfaces of the airfoil. A servo mechanism responsive to the change in the pressure differential is coupled to the airfoil to extend and retract the airfoil segments to maintain the pressure at a maximum on the downstream side of the airfoil relative to the pressure on the upstream side of the airfoil. At low speeds, such as at take-offs and landings, the airfoil is fully extended while at high speeds it is fully retracted. NASA

N73-32625# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

APPLICATION OF HYDRODYNAMIC SIMULATION TO THE STUDY OF COMBUSTION CHAMBERS

Andre Benoit [1973] 7 p refs In FRENCH; ENGLISH summary Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972

Avail: NTIS HC $3.00

Hydrodynamic analogy techniques provide simple means of visualization of the features of the complex flow field within a combustor. A facility including a large water tank with a converging duct leading to a mock-up of a section of turboreactor combustor is described. Results on the observed penetration of primary and secondary injections on the vorticity generation within the primary zone and on the distribution of mass flow rates between the orifices are also presented. Author

N73-32626# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PERFORMANCE OPTIMIZATION FOR SUPERSONIC RAMJET THEORETICAL AND EXPERIMENTAL STUDIES

Francis Hirsinger 1972 12 p refs In FRENCH; ENGLISH summary Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972

Avail: NTIS HC $3.00

Simple theoretical studies show off a combustion process called transition combustion, which is of interest for airbreathing propulsion by means of fixed geometry ramjets, and permits emphasis on some principles for the performance, optimization. During this combustion, which is initiated at subsonic speed, the stream is accelerated, through a thermal throat, up to a supersonic speed. Experimental tests were run which confirm the existence of this phenomenon and have helped to elaborate a mathematical pattern fitted to a proper description of the flow. This pattern may be used successfully for the prediction of the optimal performances. Computed results show that the so defined configuration leads to competitive performances in a wide domain of flight velocity. Author

N73-32627*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TECHNIQUE FOR PREDICTING HIGH-FREQUENCY STABILITY CHARACTERISTICS OF GASEOUS-PROPELLANT COMBUSTORS

Richard J. Priem and Y. S. Yang Jefferson Washington Oct. 1973 40 p refs

(NASA-TN-D-7406; E-7473) Avail: NTIS HC $3.00 CSCL 21H

A technique for predicting the stability characteristics of a gaseous-propellant rocket combustion system is developed based on a model that assumes coupling between the flow through the injector and the oscillating chamber pressure. The theoretical model uses a lumped parameter approach for the flow elements in the injection system plus wave dynamics in the combustion chamber. The injector flow oscillations are coupled to the chamber pressure oscillations with a delay time. Frequency and decay (or growth) rates are calculated for various combustor design and operating parameters to demonstrate the influence of various parameters on stability. Changes in oxidizer design parameters had a much larger influence on stability than a similar change in fuel parameters. A complete description of the computer program used to make these calculations is given in an appendix. Author

N73-32628# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahl-antriebe.

A NON-CONTACT METHOD FOR SUPERVISION AND MEASUREMENT OF THE EFFECTIVE GAP BETWEEN ROTOR BLADES AND CASING OF TURBOMACHINE DURING OPERATION [UEBER EIN BERUEHRUNGSLOSES VERFAHREN ZUR UEBERWACHUNG UND MESSUNG DER EFFEKTIVEN SPALTE ZWISCHEN DEN LAUFRADSCHAU-FELN UND DEM GEHAEUSE VON TURBOMASCHINEN WAEHREND DES BETRIEBS]

Hans Hungenberg and Heinrich Weyer 27 Jun. 1972 33 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-40) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 11,30 DM

A contactless, capacitive method for measuring the gaps between the rotor blades and the casing of a running turbomachine is discribed. The main parameters affecting this method are explained. From this, the most practical calibration of the probe was derived and the limits of the measuring accuracy are shown. Directions for the construction of the probe are given, and some results from measurements of the tip clearance in an axial flow compressor are presented. Author (ESRO)

N73-32629# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.

POWER CONDITIONING SUB-ASSEMBLY TESTS CARRIED OUT ON ION THRUSTOR OF SINGLE JET DISK-TYPE AT ONERA [ESSAIS DU SOUS ENSEMBLE CONDITIONNE-MENT DE PUISSANCE EFFECTUES SUR UN PROPULSEUR MONOBOUTON A L' ONERA]

Labbe, (ONERA, Toulouse) and Briot Jun. 1973 33 p In FRENCH

(CAAS-TNPE-73-T-17) Avail: NTIS HC $3.75

Performance tests of the power supplies for a single jet disk type cesium thrustor are presented. Positive and negative HT power supply, pilot subsystem, and beam current control loop behavior during a 13 hour test period are discussed. The control loop is triggered by the temperature of the vaporization tank, and experimental results are in agreement with theoretical predictions. The tank high thermal inertia results in a perturbation decay time of 5 minutes for a regulation coefficient of about 4% at 8.4 mA beam current. ESRO

N73-32630# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.

HYDRAULIC FLIP BEHAVIOR IN TYPICAL LIQUID ROCKET OPERATING REGIMES Final Report, Apr. 1971 - Aug. 1972

Thomas J. C. Chew Jul. 1973 52 p refs

(AF Proj. 5730)

(AD-764730; AFRPL-TR-72-127) Avail: NTIS CSCL 21/8

An experimental investigation on hydraulic flip behavior at typical liquid rocket injector design and operating conditions was completed. Both nitrogen tetroxide and water were used as test fluids. The results were analyzed to show the effect of chamber pressure, orifice L/D, orifice diameter and cross-flow velocity on the occurrence of hydraulic flip. Comparison of experimental results with the theoretical models developed by Ito was made. It was concluded that chamber pressure and orifice L/D strongly affect the occurrence of hydraulic flip while orifice diameter and cross-flow velocity influence hydraulic flip to a much lesser degree. The theoretical models were found to be inadequate for predicting hydraulic flip. The conditions for the occurrence of flip appear nearly the same for both nitrogen tetroxide and water. Author (GRA)

N73-32631# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF THE THEORY OF SIMILITUDE TO THE DESIGN OF CONTROL SYSTEMS FOR GAS TURBINE ENGINES

Yu. V. Lyubomudrov 25 May 1973 267 p refs Transl. into ENGLISH from Mono. "Primenenie Teorii Podobiya pri Gazoturbinnykh Dvigatelei" Moscow, 1971 p 1-20

(AD-764683; FTD-HC-23-1340-72) Avail: NTIS CSCL 21/5

The report discusses the questions related to optimum design using the theory of similitude of automatic control systems for aircraft gas turbine engines (GTE) considered as objects with characteristics varying during flight. The equation of motion of the controlled object, expressed in terms of reduced variables, is unique for all conditions of its operation and may be represented as a graph of the dynamic characteristic of a GTE that can be used as a basis to determine the required control laws. The selection of the optimal formula for the control system is done by using power complexes of GTE parameters. A foundation is provided for the principles of designing a single control system that combines higher reliability of control in the entire range of flight conditions with reliability of control. GRA

N73-32632# ARO, Inc., Arnold Air Force Station, Tenn.

MEASUREMENT OF EXHAUST EMISSIONS FROM A 185-GE-5B ENGINE AT SIMULATED HIGH-ALTITUDE SUPERSONIC FREE-STREAM FLIGHT CONDITIONS Technical Report, 15 Dec. 1972 - 10 Jan. 1973

R. C. German, M. D. High, and C. E. Robinson AEDC Jul. 1973 140 p refs

(Contract DOT-AS-20024; ARO Proj. PA038; ARO Proj. PB038)

(AD-764717; ARO-PWT-TR-73-49; AEDC-TR-73-103; FAA-RD-73-92) Avail: NTIS CSCL 21/5

Exhaust emissions were measured in the plume of a J85-GE-5 turbojet engine as part of an investigation to determine the impact on the climate of a fleet of supersonic aircraft flying in the stratosphere. Measurements were made for both military and partial afterburning power at Mach numbers and simulated altitudes of Mach 1.6/55,000 ft and Mach 2.0/65,000 ft. A continuous sampling technique was used to measure carbon dioxide, carbon monoxide, total unburned hydrocarbons, oxides of nitrogen, and particulates. The experimental results were compared with the calculated emission profiles and were in good agreement. The results represent the only available full-scale turbojet engine emission data to date which have been obtained at simulated high altitude with a supersonic external stream. (Modified author abstract) GRA

N73-32633# Dayton Univ. Research Inst., Ohio.

A COMPUTER PROGRAM FOR AXIAL COMPRESSOR DESIGN. VOLUME 1: THEORY DESCRIPTIONS, AND USERS INSTRUCTIONS Final Technical Report, 16 Jun. 1972 - 15 Jun. 1973

Richard M. Hearsey Jul. 1973 96 p refs 2 Vol.

(Contract F33615-72-C-2026; AF Proj. 3066; AF Proj. 7065)

(AD-764733; AFAPL-TR-73-66-Vol-1) CSCL 21/5

A computer program for the design of axial compressors is presented. It comprises of three principal sections, two alternative means of determining blade geometry, and an aerodynamic computation for the flow through the compressor. One method of determining blade geometry revolves around the use of various analytic meanlines for the blade sections, and leads to the aerodynamic analysis of the flow through specified blading. The other method consists of creating arbitrary blade sections to follow the flow directions previously determined in an aerodynamic design calculation. The aerodynamic design section incorporates a loss calculation routine that may be used to estimate the design point performance of the compressor. The report describes the computer program, and gives all information necessary to use it. (Modified author abstract) GRA

N73-32634# Dayton Univ. Research Inst., Ohio.

A COMPUTER PROGRAM FOR AXIAL COMPRESSOR DESIGN. VOLUME 2: PROGRAM LISTING AND PROGRAM USE EXAMPLE Final Technical Report, 16 Jun. 1972 - 15 Jun. 1973

Richard M. Hearsey Aug. 1973 160 p 2 Vol.

(Contract F33615-72-C-2026; AF Proj. 3066; AF Proj. 7065)

(AD-764734; AFAPL-TR-73-66-Vol-2) Avail: NTIS CSCL 21/5

A computer program for the design of axial compressors is presented. It comprises of three principal sections; two alternative means of determining blade geometry, and an aerodynamic computation for the flow through the compressor. The report shows the FORTRAN program listing and an example of the use of the program. (Modified author abstract) GRA

N73-32635# Utah Univ., Salt Lake City. Dept. of Civil Engineering.

MEMORY FUNCTION NORMS FOR SOLID ROCKET PROPELLANTS. PART 1: EXPERIMENTAL DEFINITION

Ahmad Usuluddin Sulijoadikusumo and J. Edmund Fitzgerald Jul. 1973 43 p refs

(Grant AF-AFOSR-2322-72)

(AD-764666; UTEC-CE-73-130) Avail: NTIS CSCL 21/9

Previously reported investigations by Fitzgerald, Farris, Hufferd and Vakili have employed Lebesgue Norms to characterize internal damage in solid propellants. The essence of the above investigations is that any previous strain history causes the material to change its properties. The present report is based upon the results of carrying out a series of one-directional and two-directional tests on an inert Minuteman Stage 1 propellant with the objective of generalizing and defining the essential character of permanent memory effects. The Chebychev Norm, essential supremum, appears to play the primary role in determining damage. The report is confined to experimental observations. (Modified author abstract) GRA

N73-32636# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

THE DESIGN OF AXIAL COMPRESSOR AIRFOILS USING ARBITRARY CAMBER LINES Final Report

George R. Frost and Arthur J. Wennerstrom Jul. 1973 106 p refs

(AF Proj. 7065)

(AD-765165; ARL-73-0107) Avail: NTIS CSCL 21/5

The report describes a technique which has been developed for use in the design of axial compressor airfoils with camber lines of arbitrary shape. The slope of the camber line at several points on a streamsurface is determined from the air angles at these points as well as the incidence and deviation angle

distributions for the blade. A camber line is produced by fitting a smooth curve segment through each pair of points from the leading to the trailing edge. A thickness distribution is applied to this camber line to produce the blade element. A computer program, which uses this technique to produce blade elements, stacks them, and then determines coordinates for plane surfaces through the resultant blade is also described.
Author (GRA)

N73-32637# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF THERMAL-STRENGTH TESTING OF THE NOZZLE UNITS OF TURBINES OF AVIATION GTE
P. F. Grigorev and M. P. Meshcheryakov 30 Jul. 1973 9 p ref Transl. into ENGLISH from Sb. Statei Prochnost i Dinamika Aviats. Dvigatelei (USSR), no. 6, 1971
(AD-764930; FTD-HT-23-797-73) Avail: NTIS CSCL 21/5
The report describes the dynamic response of gas turbine parts exposed to repetitive high temperatures. GRA

N73-32638# General Motors Corp., Indianapolis, Ind. Diesel Allison Div.
INVESTIGATION OF AIRCRAFT GAS TURBINE COMBUSTOR HAVING LOW MASS EMISSIONS Final Report
D. L. Troth, A. J. Verdouw, and F. J. Verkamp Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Apr. 1973 730 p refs
(Contract DAAJ02-72-C-0005; DA Proj. 1G1-62207-AA-71) (AD-764987; ERD-7725; USAAMRDL-TR-73-6) Avail: NTIS CSCL 13/2
The objective of this one-year program was to develop and demonstrate emission abatement technology sufficient to obtain a 50% overall reduction in gas turbine engine mass emissions (CO, CxHy, NOx and smoke) with no increase in any individual pollutant when tested over a typical Army light observation helicopter (LOH) duty cycle. The selected baseline was the Army T63-A-5A gas turbine engine combustor. Seventeen potential low-emission combustors, each incorporating one or more of the selected concepts, were tested to determine their emission performance. Experimental results indicated that several designs had the potential for meeting the program objectives. Two combustors selected for final experimental evaluation were the Prechamber and Modified Conventional. The low-emission feature in the Prechamber combustor was premix/prevaporization. The Modified Conventional combustor incorporated four low-emission features: airblast fuel atomization, delayed dilution, convection cooling, and variable geometry. Both of these combustors met the emission reduction objectives. Experimental results indicated that both of these liners can be developed to meet all other conventional T63 combustor requirements, i.e., light-off, temperature profile, durability, etc. The estimated development time for the Prechamber is longer than for the Modified Conventional. However, the Prechamber combustor has better emission reduction potential when both combustors are designed as either fixed or variable geometry combustors. (Modified author abstract) GRA

N73-32837* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATION OF SMALL ROCKET ENGINES IN THE JPL HIGH-VACUUM MOLECULAR SPACE SIMULATOR (MOLSINK)
J. E. Chirivella *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 1-13 refs (For availability see N73-32836 23-34) CSCL 21H

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-32639 New Hampshire Univ., Durham.
NEUTRON MEASUREMENTS IN SPACE WITH OGO-6 Ph.D. Thesis
Shadrach Okechukwu Ifedili 1973 261 p
Avail: Univ. Microfilms Order No. 73-16742
An experiment has been performed with a neutron detector on the OGO-6 satellite to search for solar neutrons, to measure the solar proton albedo neutron flux, and to determine the flux, latitude dependence, angular distribution, energy spectrum and the solar modulation of the cosmic ray albedo neutrons. Solar proton albedo neutron fluxes, both at high and low latitudes and for several solar proton events, were measured. The total cosmic ray leakage flux has been measured to be about 0.7 times the Lingenfelter (1963) flux while the latitude dependence is in good agreement with that calculated by Lingenfelter (1963). The form of the angular distribution of the cosmic ray albedo neutrons at the top of the atmosphere was deduced from the comparison of the measured and calculated altitude dependence of the cosmic ray albedo neutron flux. Finally, the solar modulation of the cosmic ray albedo neutrons has been observed. Dissert. Abstr.

N73-32640 Maryland Univ., College Park.
COSMIC RAYS OVER THE UPPER MIDWEST Ph.D. Thesis
Thomas Andrew Rygg 1972 181 p
Avail: Univ. Microfilms Order No. 73-17050
Differential energy spectra of cosmic ray protons and helium nuclei in the energy range 100 - 260 MeV/nucleon were measured on balloon flights from Minneapolis, Minnesota and Sioux Falls, South Dakota. The detector was a Geiger tube hodoscope operated in conjunction with two scintillation counters and lead absorbers totalling 75 gms/cm in thickness. The energy spectrum of re-entrant albedo protons was found to be essentially flat in the 100 - 200 MeV interval as is predicted by theoretical calculations of the equilibrium spectrum of secondary protons emerging from thick layers of air. Geomagnetic cutoff rigidities obtained during quiet times from the spectra of helium nuclei were variable from day to day averaging 23% below the level predicted by detailed orbited orbit calculations that invoke only internal sources of the earth's magnetic field. Dissert. Abstr.

N73-32641 Yale Univ., New Haven, Conn.
AN EXPERIMENTAL STUDY OF THE ATTENUATION OF THE SOLAR BEAM BY POLLUTION IN THE BOUNDARY LAYER OF AN URBAN ATMOSPHERE Ph.D. Thesis
William Allen Sprigg 1972 200 p
Avail: Univ. Microfilms Order No. 73-16398
A practical system was developed for continuously monitoring spectral solar intensity attenuation within an urban atmosphere. Measurements were taken between February and July, 1971, of solar intensity depletion within the lowest 100 meters of the urban atmosphere of New Haven, Connecticut. These observations yielded information as to the diurnal variability of wide spectral band attenuation as well as the day-to-day changes that may occur due to varying environmental factors. During midday clear-sky conditions, total spectrum integral attenuation coefficient averaged 0.13 per kilometer. Under very turbid atmospheric conditions, total spectrum attenuation coefficient approached values of 0.40 per kilometer. Over wide spectral bands, attenuation coefficients on the average were observed to decrease with wavelength. When solar attenuation was compared with concomitant measurements of mean city-wide sulfur dioxide concentration or soiling index, statistically significant correlations were observed. Dissert. Abstr.

N73-32642 New Hampshire Univ., Durham.
THE FLUX AND ENERGY SPECTRUM OF FAST NEUTRONS AND GAMMA RAYS AT BALLOON ALTITUDES Ph.D. Thesis
David Michael Klumpar 1973 142 p
Avail: Univ. Microfilms Order No. 73-16743
An organic liquid scintillation detector employing pulse shape discrimination was used in a series of balloon flights to measure the flux and energy spectrum of fast neutrons ($E > 3$ MeV) and gamma rays ($1 < \text{or} = E < \text{or} = 10$ MeV) near the top of the atmosphere. The differential neutron leakage spectrum from 3 to 20 MeV at the top of the atmosphere over Palestine, Texas (lambda = 42 degrees N) normalized to solar minimum can be described by a spectrum of the form 0.276 E to the -1.80 power ($3 < \text{or} = E < \text{or} = 10$ MeV), 0.035 E to the -0.9 power ($10 < \text{or} = E < \text{or} = 15$ MeV), 0.0068 E to

the -0.3 power (15 < or = E < or = 20 MeV). The spectrum above 20 MeV inferred from the data may be described by 0.003 E to the 0.0 power (20 < or = E < or = 50 MeV) and 6.98 E to the -2.0 power (50 < or = E < or = 100 MeV) neutrons/sq cm second MeV over the indicated energy ranges. The leakage current out of the atmosphere is found to be 0.09 neutrons/sq cm second between 3 and 100 MeV.
Dissert. Abstr.

N73-32643 Cornell Univ., New York.
THE ACCELERATION OF SOLAR WIND PROTONS AND HEAVY IONS Ph.D. Thesis
Arnold Otto Benz 1973 162 p
Avail: Univ. Microfilms Order No. 73-16093

Variations in the solar wind's He-4(++) abundance (relative to hydrogen) are frequently observed at 1 au (astronomical unit). They strongly indicate that some diffusive separation takes place. It is suggested that the most likely altitude for this to occur is the lower corona. Coulomb interactions prove insufficient to arrest protons with a high enough outward velocity, and therefore evaporation must take place from a great range of heights. The proton distribution and acceleration is investigated by means of a two stream model involving a population of collision-dominated particles and an evaporating population of fast, outward-going protons. At large distances, the velocity distributions of the two populations are expected to be partially equilibrated with each other by the transverse magnetic field component. Dissert. Abstr.

N73-32644 New Mexico Univ., Albuquerque.
FIRST MEASUREMENTS OF EARTH ALBEDO NEUTRONS IN SPACE Ph.D. Thesis
James Robert Place 1972 127 p
Avail: Univ. Microfilms Order No. 73-16579

OSO-6 carried as part of its payload a proton recoil telescope capable of detecting neutrons between 40 and 200 MeV with directional discrimination. Sixteen months of data from this instrument were analyzed to determine properties of the earth albedo neutron flux above the atmosphere. The variation of albedo neutron flux with geomagnetic latitude was found to be 1:4 between 0 deg and 40 deg. The angular distribution shows that about 40% fewer neutrons come upward from directly beneath the satellite compared to the number coming from a direction tangential to the top of the atmosphere. The energy spectrum between 50 and 150 MeV shows an intensity about a factor of 10 higher than had been predicted from extrapolation of lower energy calculations. Dissert. Abstr.

N73-32645*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB AND THE SUN
Jul. 1973 55 p refs
(NASA-EP-119) Avail: NTIS MF $1.45; SOD HC $0.85 CSCL 03B

Articles pertaining to the solar studies and the Skylab program are presented, with emphasis on the usefulness of the Apollo Telescope Mount (ATM) program. A description of Skylab objectives and key mission events is included along with articles about the sun. Skylab solar studies which are reported include these topics: ATM solar observatory, scientific instruments, crew operations and crew training, and the joint observing program. The Skylab associated solar programs are also reported. K.M.M.

N73-32646*# Maryland Univ., College Park. Space Physics Group.
UNIVERSITY OF MARYLAND CONTRIBUTIONS TO THE 13TH INTERNATIONAL COSMIC RAY CONFERENCE
Aug. 1973 44 p refs Conf. held at Denver, 17-30 Aug. 1973
(Grant NGR-21-002-066)
(NASA-CR-135528) Avail: NTIS HC $4.25 CSCL 03B

Papers presented at the Cosmic Ray Conference are summarized. Data cover cosmic ray particle diffusion, low energy cosmic ray particle density, solar particle oscillations, and cosmic ray electron spectrum measurements. Measurement data taken by hodoscopes, IMP-7, and radiation counters are included. For individual titles, see N73-32647 through N73-32654.

N73-32647* Maryland Univ., College Park. Dept. of Physics and Astronomy.
COSMIC RAY HYSTERESIS AS EVIDENCE FOR TIME-DEPENDENT DIFFUSIVE PROCESSES IN THE LONG TERM SOLAR MODULATION
J. J. OGallagher *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 1-6 refs (For availability see N73-32646 23-29)
(Grant NGL-21-002-033)
(TR-73-131) CSCL 03B

A simple one-dimensional time-dependent diffusion-convection model for the modulation of cosmic rays is presented. This model predicts that the observed intensity at a given time is approximately equal to the intensity given by the time independent diffusion convection solution under interplanetary conditions which existed a time iota in the past, (U(t sub o) = U sub s(t sub o - tau)) where iota is the average time spent by a particle inside the modulating cavity. Delay times in excess of several hundred days are possible with reasonable modulation parameters. Interpretation of phase lags observed during the 1969 to 1970 solar maximum in terms of this model suggests that the modulating region is probably not less than 10 a.u. and maybe as much as 35 a.u. in extent. Author

N73-32648* Maryland Univ., College Park. Dept. of Physics and Astronomy.
DIRECT OBSERVATIONS OF THE CHARGE STATES OF LOW ENERGY SOLAR PARTICLES
G. Gloeckler, C. Y. Fan (Ariz. Univ., Tucson), and D. Hovestadt (Max-Planck Inst. fuer Extraterrestrische Phys.) *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 7-12 refs (For availability see N73-32646 23-29)
(Contract NAS5-11063; Grant NGR-21-002-224)
(TR-73-132) CSCL 03B

The charge states of carbon and oxygen of solar origin were measured directly in interplanetary space. At 100 keV per nucleon the C(+5)/C(+6) and O(+7)/O(+8) ratios are 1.8 and 1.6 respectively. It was found that the abundance ratios of low energy heavy nuclei to He is significantly larger than corresponding photospheric values: the enhancement of O/He is 35 and both Si/He and Fe/He are overabundant by a factor of 100. To explain these observations a mechanism is proposed which first preferentially accelerates heavy ions and is followed by either storage of these ions in the coronal regions or strong adiabatic deceleration. Author

N73-32649* Maryland Univ., College Park. Dept. of Physics and Astronomy.
COHERENT PROPAGATION OF CHARGED PARTICLE BUNCHES IN RANDOM MAGNETIC FIELDS
James A. Earl *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 13-18 refs (For availability see N73-32646 23-29)
(TR-73-133) CSCL 03B

Cosmic ray particle transport in random magnetic fields is analyzed. Data cover particle transport in which q is greater than or equal to 2, and density inhomogeneities propagate in a wavelike fashion with very little dispersion. Physical interpretations rather than mathematical proofs are emphasized. E.H.W.

N73-32650* Maryland Univ., College Park. Dept. of Physics and Astronomy.
BALLOON OBSERVATIONS OF RAPID VARIATIONS IN SOLAR PARTICLE FLUX DURING JULY 1972
Lawrence E. Bagg, James A. Earl, and Janet G. Luhmann *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 19-22 refs (For availability see N73-32646 23-29)
(TR-73-134) CSCL 03B

Solar energetic particles were observed with excellent time resolution with the aid of a large hodoscope flown on a balloon. A transient increase in the intensity of solar protons which can be interpreted in considerable detail as evidence for the coherent propagation of particles injected by a west limb flare occurring at 1025UT on July 22, 1972 is reported. Author

N73-32651* Maryland Univ., College Park. Dept. of Physics and Astronomy.

HODOSCOPE MEASUREMENTS OF THE SPECTRUM OF COSMIC ELECTRONS BETWEEN 10 GeV AND 100 GeV
Charles A. Meegan and James A. Earl *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 23-24 refs (For availability see N73-32646 23-29)
(TR-73-135) CSCL 03B

In an attempt to reduce divergences among independent measurements of the electron spectrum above 10 GeV, electrons were detected with the aid of a large hodoscope which incorporates 8 trays of Geiger tubes and 10 scintillation counters into a calorimeter containing 33 radiation lengths of lead. This instrument was thoroughly calibrated up to 9 GeV with an electron synchrotron and was flown twice at a depth of 5 g/sq cm for a total of 30 hours at ceiling. Electron showers at 10 GeV are completely contained within the calorimeter where their ionization is sampled twelve times, and where hodoscope trays provide information on the geometrical distribution of shower particles. Electrons appeared in a histogram of number of events vs. a X2 measure of goodness of fit to electron shower curves as a clearly resolved peak standing well above the nuclear background. The initial ionization and the lateral spread of shower particles are consistent with those of calibration electrons. In contrast, the behavior of the nuclear continuum associated with minimum ionizing incident particles is different from that of calibration electrons but similar to that of nuclear events associated with incident helium nuclei. The differential electron spectrum from 10 to 100 GeV was obtained. Author

N73-32652* Maryland Univ., College Park. Dept. of Physics and Astronomy.
CHEMICAL ABUNDANCES OF COSMIC RAYS GREATER THAN 4.5 GV MEASURED WITH A LARGE AREA PROPORTIONAL COUNTER-SCINTILLATION COUNTER STACK
Jacques LHeureux (Ariz. Univ., Tucson), C. Y. Fan (Ariz. Univ., Tucson), G. Gloeckler, and R. Mainardi *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 25-29 refs (For availability see N73-32646 23-29)
(Grant NGR-03-002-107; NGR-21-002-224)
(TR-73-136) CSCL 03B

A 6500 sq cm-ster cosmic ray detector consisting of twelve gas counter trays sandwiched between two large area circular scintillation counters was flown from Palestine, Texas in November of 1972 to study the composition of primary particles > 1.5 GeV/nucleon in the charge range 3 to 30. For each analyzed event, a recording was made of (1) the particle trajectory using four 20 wire proportional counter trays, (2) the energy loss in each of the solid counters, and (3) the dE/dx losses in each of the twelve gas counters. The large dynamic range of the detector is established by operating six of the gas counters in the ionization mode. A description of the instrument and some preliminary results are given. Author

N73-32653* Maryland Univ., College Park. Dept. of Physics and Astronomy.
INTENSITY OSCILLATION OF LOW ENERGY SOLAR PARTICLES OBSERVED ON THE IMP 7 SATELLITE
C. Y. Fan (Ariz. Univ., Tucson), G. Gloeckler, and D. Hovestadt (Max-Planck Inst. fuer Extraterrestrische Phys.) *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 30-35 refs (For availability see N73-32646 23-29)
(Contract NAS5-11063; Grant NGR-03-002-107; NGR-21-002-224)
(TR-73-137) CSCL 03B

Solar flare particles in the energy range from 125 to 160 KeV per charge were detected and analyzed by an electrostatic deflection vs. energy instrument on board the Explorer 47 (IMP 7) satellite. A harmonic analysis of the counting rates shows that frequently, the fluctuation of the particle flux can be approximately represented by N(t) = f(t)sin 2 pi nu t where f(t) is a smoothly varying function of t. The oscillation frequency nu varies from flare to flare and is of the order of 2 x .001/sec. The physical implications of the finding are discussed. Author

N73-32654* Maryland Univ., College Park.
MEASUREMENT OF ELEMENTAL ABUNDANCE OF VERY LOW ENERGY SOLAR COSMIC RAYS
D. Hovestadt (Max-Planck Inst. fuer Extraterrestrische Phys.), O. Vollmer (Max-Planck Inst. fuer Extraterrestriche Phys.), G. Gloeckler, and C. Y. Fan (Ariz. Univ., Tucson) *In its* Univ. of Md. Contrib. to the 13th Intern. Cosmic Ray Conf. Aug. 1973 p 36-41 refs (For availability see N73-32646 23-29)
(TR-73-138) CSCL 03B

Heavy interplanetary particles were observed during a solar flare period between October 29 and November 4, 1972. The nuclear abundance was determined by a two parameter analysis (dE/dx vs E technique) of a thin window proportional counter - solid state detector device aboard the Explorer 47 (IMP-7) satellite. Energy spectra are given for C, O and Fe. The elemental abundance relative to oxygen is determined for carbon, neon, magnesium, silicon and the iron group in the energy range 0.62 to 6.9 MeV/nucleon. For the Fe/O ratio no energy dependence could be observed within the error limits. Author

N73-32655*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLAT-PLATE COLLECTOR PERFORMANCE EVALUATION. THE CASE FOR A SOLAR SIMULATION APPROACH
F. F. Simon and Paul Harlamert 1973 21 p refs Presented at Intern. Solar Energy Soc., Cleveland, 3-4 Oct. 1973
(NASA-TM-X-71427; E-7670) Avail: NTIS HC $3.25 CSCL 03B

A method is proposed for determining the performance of flat-plate solar collector using a simulated sun. Collector test variables that will help establish the basis for the indoor test facility at the Lewis Research Center are discussed. The use of the indoor testing should permit a standard test for the convenient and accurate determination of collector performance. Preliminary test results are reported as an example of the type of collector performance data to be expected from the simulation approach. Author

N73-32715* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLASMA COLUMN CHANGES AT SMALL SOLAR ELONGATIONS
P. S. Callahan *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 471-472 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-32656 State Univ. of New York, Stony Brook.
GAS PROPORTIONAL COUNTING OF Cl-36 IN IRON TARGETS AND IRON METEORITES Ph.D. Thesis
Albert Shih-Cheang Cheng 1972 106 p
Avail: Univ. Microfilms Order No. 73-10889

Cl-36 from targets and meteorites along with NaCl carrier was prepared as chloromethane gas and measured by gas proportional counting thereby increasing the sensitivity of Cl-36 analysis. In previous methods Cl-36 was counted as AgCl, NaCl or NH4Cl in an end window counter or a screen wall counter. The production cross sections for Cl-36, Ar-39 and Ar-42 of thin iron targets irradiated with 0.60, 3.0 and 29 GeV protons were measured. Cl-36 activities and Ar-36 concentrations in El Taco meteorites samples indicate that present day cosmic ray intensity is (0.92 plus or minus 0.07) times the average cosmic ray intensity during the last one million years. Dissert. Abstr.

N73-32657 Illinois Univ., Urbana.
A PROBABILISTIC APPROACH TO TRAJECTORY SENSITIVITY Ph.D. Thesis
Yves Raymond Jean-Baptiste Hontoir 1973 106 p
Avail: Univ. Microfilms Order No. 73-17563

Trajectory sensitivity is concerned with the investigation of the perturbations in trajectory of dynamical systems induced by small variations in initial conditions and parameters. Existing trajectory sensitivity methods of analysis and synthesis follow a

deterministic approach. In cases of practical interest, a probabilistic approach is more appropriate to provide a comprehensive view of trajectory dispersion due to ah a priori known distribution of initial conditions and plant parameters. Such a probabilistic approach is developed in this work. The concepts of sensitivity hypertubes, equilikelihood hypertubes and nominal trajectory likelihood are introduced and lead to new measures of sensitivity whose properties are discussed. A detailed quantitative analysis of sensitivity alteration due to the use of a quadratic optimal feedback control rather than its nominally equivalent open-loop realization is presented. The generally simultaneous occurrence of elements favorable and unfavorable to sensitivity reduction is stressed and clarified. Dissert. Abstr.

N73-32658 Maryland Univ., College Park.
A STUDY OF A REGION IN MONOCEROS Ph.D. Thesis
Rodney Kip Riddle 1972 244 p
Avail: Univ. Microfilms Order No. 73-17048

Using new UBVH gamma photometry and spectral classifications for 48 stars in the Monoceros region, the membership of the dispersed part of the I Mon association is examined and 19 probable members are identified. A variable extinction solution based on these members along with 10 probable members of NGC2244, which is the most dense part of the I Mon association, gives a value of 1720 + or - 80pc for the distance to the association. The values of the ratio of total-to-selective absorption, R, and the color-excess ratio, chi are discussed from both the theoretical and observational standpoints, and the values found appropriate for use in this region are 2.98 + or - 0.23 and 0.70 + or - 0.01, respectively. The color-magnitude diagram suggests that the dispersed group of I Mon stars is older than the cluster NGC2244. Dissert. Abstr.

N73-32659 Florida Univ., Gainesville.
OBSERVATIONS OF JUPITER'S DECAMETRIC RADIATION WITH A VERY LONG BASELINE INTERFEROMETER Ph.D. Thesis
Michel Allan Lynch 1972 170 p
Avail: Univ. Microfilms Order No. 73-15587

The results of several types of measurements made on the decametric electromagnetic radiation from the planet Jupiter using a very-long-baseline interferometer are presented. Jovian signals were received at stations located at Old Town, Florida, St. Petersburg, Florida, Maipu, Chile, and Bowling Green, Kentucky. The interferometer baselines ranged from 11,150 to 456,000 wavelengths of the 18 MHz receiving frequency. Interference of the signals was accomplished by using the cross correlation function with digitized data in a program for the IBM 360/65. By interpreting the amplitude of the cross correlation function as the fringe visibility, an upper limit on the angular size of the source of the radiation was determined to be 0.1 seconds of arc if it were assumed that the source was incoherent and had a Gaussian brightness distribution. Dissert. Abstr.

N73-32660 Wisconsin Univ., Madison.
ULTRAVIOLET SPECTROPHOTOMETRY OF NOVA SERPENTIS 1970 Ph.D. Thesis
John Sill Gallagher, III 1972 157 p
Avail: Univ. Microfilms Order No. 73-10712

Photometric observations of Nova Serpentis 1970 made on the OAO-A2 between February 18 and April 13, 1970 have been reduced for filters with centroid wavelengths of 1430, 1550, 1910, 2460, 2980, 3320, and 4250 A. These observations show the nova became progressively bluer during the early decline; no signal was detected shortward of 2000 A in February, but by late March the nova was detected at all of the above wavelengths. Interpretation of these observations in terms of absolute flux distributions requires that a substantial and, in the far ultraviolet, uncertain correction be made for interstellar extinction. With this correction, the reduced data show that the wavelengths of maximum emission moves from longward of 5460 A near visual maximum to shortward of 2000 A by early April. The total flux as estimated from the photometry remained constant to within a factor of 2 over the entire observing period. Dissert. Abstr.

N73-32661 State Univ. of New York, Stony Brook.
A STUDY OF THE INFRARED SPECTRA OF K-GIANTS Ph.D. Thesis
Stephen Thurman Ridgway 1972 173 p
Avail: Univ. Microfilms Order No. 73-15908

The construction of a rapid scanning Fourier spectrometer system for astronomical infrared spectroscopy and photometry is described. Problems of phase error, nonuniform mirror velocity, and atmospheric extinction are studied. A survey of 16 bright K-giants exhibits a strong correlation between CN excess and CO excess. Using model atmospheres and spectral synthesis, the C-12/C-13 ratio is shown to be in the range 10 to 30 for most of the stars. The significance of these results is considered in the light of present understanding of stellar evolution. Dissert. Abstr.

N73-32662 Illinois Univ., Urbana.
THE DUST TAIL OF COMET SEKI LINES Ph.D. Thesis
Bruno Jean Jambor 1973 101 p
Avail: Univ. Microfilms Order No. 73-17570

Comet Seki-Lines (1962c) is a member of a remarkable group of comets which show a split tail. A series of plates were taken which eliminate the gas-ion emission due to a combination of plate sensitivity and filter transmission. The dust tail was mapped isophotometrically to show relative intensities. The Finson and Probstein method was used to calculate the dynamics of the dust grains and the resultant relative brightness of the tail. A good fit to the isophote map is obtained by using a model which features: (1) a sudden increase in the rate of release of the dust near perihelion, followed by a similarly fast decrease and a slow recovery nearly to the original level, and (2) a size distribution favoring large particles with the most common size of the order of 200 microns. The phenomenon of excessive dust production close to perihelion and the sizes of the grains released are in accord with the work of Huebner. Split tails have been observed in comets before, but in this case the nature of the tail, (dust or gas), has been determined and a suggestion made about the origin of the split tail. Dissert. Abstr.

N73-32663 California Univ., Riverside.
RADIATION BELT DIFFUSION APPLIED TO JUPITER Ph.D. Thesis
Kent Gardner Stansberry 1972 201 p
Avail: Univ. Microfilms Order No. 73-15642

The electron and proton radiation belts of the planet Jupiter are studied. The theory of radial diffusion by violation of the third adiabatic invariant is used to predict a flux model for trapped electrons at Jupiter. The electron model is evaluated by comparing the measured values of Jupiter's decimeter flux density spectrum, equatorial strip scans, and degree of polarization with the values calculated using synchrotron radiation theory. The theory and data are also compared for systematic variations of the parameters that define the electron model. A flux model for trapped protons at Jupiter is predicted using assumptions consistent with the electron assumptions and results. Dissert. Abstr.

N73-32664 Florida Univ., Gainesville.
THE LIGHT CURVES OF W URSAE MAJORIS SYSTEMS Ph.D. Thesis
Ian Stuart Rudnick 1972 176 p
Avail: Univ. Microfilms Order No. 73-15595

Two synthetic light curves computed from theoretical astrophysical models of W Ursae Majoris systems are discussed. Solutions of these light curves, based on the geometrical Russell model and the Russell-Merrill method of solution of the light curves of eclipsing binaries, are presented. The relatively shallow minima caused by the partial eclipses of the first synthetic light curve lead to a problem of indeterminacy in the solution. The observed points in the shoulders of both synthetic light curves fall below the theoretical light curves predicted by the solutions. The addition of third light in the solution of the synthetic light curves improves the fit of the solutions to the light curves; however, there is no sound basis for adding this third light. Dissert. Abstr.

N73-32665 Case Western Reserve Univ., Cleveland, Ohio.
AN INFRARED SPECTRAL CLASSIFICATION SYSTEM Ph.D. Thesis
Gerardus Dingeman Bouw 1973 60 p

Avail: Univ. Microfilms Order No. 73-16115

A quantitative spectral classification scheme is presented that uses hydrogen lines of the Paschen series nos. 12 through 16 and OI lambda 7774. The most effective region of application in the H-R diagram for this system is limited to spectral types A5 through G0 and to luminosity classes Ia through II. Over this region, the IR classification system is at least as sensitive as the revised MK system in luminosity and about 0.5 times as accurate in temperature class. Spectral types on the new infrared classification system, and visual absolute magnitudes, based on the infrared spectra and the revised luminosity calibration, are given for a total of 80 program stars. Dissert. Abstr.

N73-32666 Case Western Reserve Univ., Cleveland, Ohio.
BLUE VIOLET INTENSITY DISTRIBUTION IN S, C-S AND C STARS Ph.D. Thesis
Hazel E. Ross 1973 60 p
Avail: Univ. Microfilms Order No. 73-16151

Blue to violet intensity distributions are given for fifteen S, three C-S, and three C stars. The violet depression increases continuously from S stars to N-type carbon stars. It is suggested that the violet opacity mainly responsible for this depression originates in the upper layers of the star's atmosphere. Solid SiC appears to be a strong candidate for the agent causing the violet depression, although it is not clear whether SiC can be sufficiently abundant in the S stars. The characteristics curve can be fitted by an exponential fit for the toe, merging with a linear fit for the linear portion. The characteristic curve is then described by two parameters. Variations of these parameters with wavelength, exposure time, and background fog are discussed. Dissert. Abstr.

N73-32667 Florida Univ., Gainesville.
PHOTOELECTRIC STUDY OF EE AQUARII AND AE PHOENICIS Ph.D. Thesis
Richard Michael Williamon 1972 199 p
Avail: Univ. Microfilms Order No. 73-15608

Photoelectrically observed light curves of the eclipsing binary star systems EE Aquarii and AE Phoenicis were obtained using the thirty-inch reflecting telescope at the University of Florida's Rosemary Hill Observatory and the number one, sixteen-inch telescope at Cerro Tololo Interamerican Observatory near LaSerena, Chile, respectively. The observational data from EE Aquarii was obtained on eleven nights in August, September, and October, 1970, and on three nights in August and September, 1971. A total of 309 302, and 299 usable observations were obtained in yellow, blue, and ultraviolet light for EE Aquarii, and 242 observations were obtained in each of the colors yellow, blue, and ultraviolet for AE Phoenicis. In both cases, the colors corresponded to the colors of the (UBV) system of Johnson and Morgan. Dissert. Abstr.

N73-32668# Joint Publications Research Service, Arlington, Va.
LUNAR GEOLOGY
Yu. A. Khodak and G. U. Likhosherstnykh 27 Aug. 1973 28 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geol. (USSR), no. 11, 1972 p 3-14 and Mat. Metody v Geol. (USSR), no. 2, 1971/1972 p 104-110
(JPRS-59895) Avail: NTIS HC $3.50

Artciles are presented on the possible evolution and petrochemical differentiation of the moon and on tides as an energy factor in the geological activity on the moon. For individual titles, see N73-32669 through N73-32670.

N73-32669 Joint Publications Research Service, Arlington, Va.
ON THE POSSIBLE EVOLUTION AND PETROCHEMICAL DIFFERENTIATION OF THE MOON
Yu. A. Khodak *In its* Lunar Geol. (JPRS-59895) 27 Aug. 1973 p 1-7 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geol. (USSR), no. 11, 1972 p 3-14 (For availability see N73-32668 23-30)

The distribution pattern of chemical components and the petrochemical coefficients of lunar rocks are discussed in terms of the formation and development of planetary bodies. The differentiation of the material and the formation of the moon's structure is considered to have occurred about 1 to 1.5 billion years ago with the formation of seas and cirques, i.e. in the Vulcanian era at the end of the Middle Proterozoic period, relative to the earth. It is concluded that in studying the moon, a solution to the questions associated with the formation and development of planetary bodies in our solar system is impossible without a petrologic-geologic planetologic analysis. F.O.S.

N73-32670 Joint Publications Research Service, Arlington, Va.
TIDES AS AN ENERGY FACTOR IN THE GEOLOGICAL ACTIVITY OF THE MOON
G. U. Likhosherstnykh and Yu. A. Khodak *In its* Lunar Geol. (JPRS-59895) 27 Aug. 1973 p 18-25 refs Transl. into ENGLISH from Mat. Metody v Geol. (USSR), no. 2, 1971/1972 p 104-110 (For availability see N73-32668 23-30)

The energy released by the tidal processes on the moon is discussed in terms of lunar matter activation. The motion of the tidal waves, and the regions of intensified tidal activity due to the two librations are analyzed along with the distribution of the mascons on the visible side of the moon. The global temperature structure of the moon is described. F.O.S.

N73-32671# Joint Publications Research Service, Arlington, Va.
RADIOASTRONOMY
7 Sep. 1973 47 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 35 p
(JPRS-59985) Avail: NTIS HC $4.50

Soviet articles are presented on the technology associated with the design and operation of radiotelescope antennas. For individual titles, see N73-32672 through N73-32678.

N73-32672 Joint Publications Research Service, Arlington, Va.
A SYSTEM FOR AUTOMATING OBSERVATIONS ON THE RTI-7.50/250 MVTU RADIOTELESCOPE
A. A. Parshchikov, B. A. Rozanov, V. S. Sagatelov, and N. E. Bauman *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 1-5 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 703-706 (For availability see N73-32671 23-30)

The design is described of a high precision synchronous-tracking drive system for the RTI-7.50/250 antennas. Implementation of the system permits the antennas to operate in any of the following modes: (1) automatic guidance and tracking, with or without scanning of the target; (2) semiautomatic guidance of slow and rapid motion; (3) automatic tracking per a photo-guide; (4) rapid resetting of antennas in all operating-angle bands; and (5) functional monitoring of the whole control complex in a local control mode. The results of tests of the system indicate that it has the necessary stability reserve in all modes, and provides the required precision at the given target speeds. D.L.G.

N73-32673 Joint Publications Research Service, Arlington, Va.
THE DEVELOPMENT OF STRUCTURAL METHODS FOR INCREASING THE EFFECTIVENESS OF FULLY ROTATABLE PARABOLIC ANTENNAS c09
A. G. Sokolov and V. S. Polyak *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 6-13 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 655-660 (For availability see N73-32671 23-30)

The problems are discussed which result from attempts to increase the effective area of fully rotatable reflector antennas and to increase the operating frequency. The basic problem is shown to be that of overcoming the imposed deformational limits. Various methods are discussed for improving the structural shapes of the antennas, which will permit a reduction of the structural rigidity requirements. Emphasis is placed on an approach which involves compensation for distortions in antenna shape by the selection of mechanisms for building the structure, and by arrangement of the support framework stiffening members in such fashion that the deformed surface remains parabolic but has a different focal distance and different orientation in space. D.L.G.

N73-32674 Joint Publications Research Service, Arlington, Va.
OPTICAL MODELING OF THE RADIATION PATTERN OF A VARIABLE PROFILE ANTENNA OPERATING IN THE HARTMAN DIAPHRAGM MODE c07
A. N. Korzhavin and V. M. Spitkovskiy *In its* Radioastronomy

(JPRS-59985) 7 Sep. 1973 p 14-18 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 661-664 (For availability see N73-32671 23-30)

The case is considered of a variable profile antenna operating in the Hartman diaphragm mode, when the central portion of the reflector at the source of radio frequency radiation is eliminated. In this case, it was possible to determine the position of the focal points for the remaining usable portion by the use of approximation formulas. In order to verify these computations an optical model was utilized, and the data obtained were fitted to a curve of the experimental field amplitude distribution. The results from both methods were then compared to a traverse curve of a radio frequency source across the radiation pattern of the antenna operating in the research mode. The comparison indicates satisfactory agreement with the optical model calculations, and less agreement with the approximate computations D.L.G.

N73-32675 Joint Publications Research Service, Arlington, Va.
METHOD OF ALIGNMENT AND TECHNOLOGY OF FABRICATING RTI-7 5/250 MVTU RADIOTELESCOPE ANTENNAS **c09**
A. A. Parshchikov, B. A. Rosanov, V. S. Sagatelov, and A. A. Tanygin *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 19-22 refs Transl. into ENGLISH from Izv. Uyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 665-668 (For availability see N73-32671 23-30)

A method is described for alignment of the antennas based on the parabola's characteristic of focusing parallel rays at a single point. The method described, in addition to essentially increasing precision, eliminates fabrication of expensive control models. The results of multiple measurements indicate that the root-mean-square deviation of the operating edge of the antenna model from the theoretical parabola is 17 microns. A fabrication procedure for the antenna's reflecting surface, using the proposed alignment method, is also described. D.L.G.

N73-32676 Joint Publications Research Service, Arlington, Va.
PARAMETERS OF THE RT-22 KrAO RADIOTELESCOPE ANTENNA AT WAVELENGTHS OF 3 AND 1.35 CENTIMETERS **c09**
L. D. Bakhrakh, M. I. Grigoryeva, V. A. Efanov, L. R. Kogan, V. I. Kostenko, L. I. Matveyenko, I. G. Moiseyev, and Yu. G. Monin *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 23-29 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 675-679 (For availability see N73-32671 23-30)

Studies are described which were conducted on a two-reflector antenna system for the RT-22 radiotelescope. The studies resulted in the following accomplishments: (1) sensitivity of the antenna was increased; (2) electrical parameters were defined, including correction factors for the axis position; and (3) conditions were created for using a quantum paramagnetic amplifier on the radiotelescope. D.L.G.

N73-32677 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF THE POLARIZATION CHARACTERISTICS OF THE LARGE PULKOVO RADIOTELESCOPE **c07**
N. A. Yesenkina, N. S. Bakhvalov, L. G. Vasilyeva, N. A. Soboleva, and A. V. Temirova *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 30-38 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 669-675 (For availability see N73-32671 23-30)

The problem is considered of determining the distribution of radiowave intensity in all of the Stokes' parameters for radio frequency radiation sources. It is shown that the basic difficulty stems from the fact that the Stokes' parameters at the receiver equipment output differ from the sources' true parameters. Using three matrix operators, the relationship between the parameters is formulated. The matrix operators describe: (1) the effect of the receiver-amplifying equipment and the input circuit on the radiation being studied, (2) the effect of the antenna system, and (3) the effect of the medium between the source and the observer. The relationship is then applied to the Pulkovo radiotelescope to examine the effect of a variable profile antenna on the radiation being studied. Finally, the formulation is extended to determine the polarization characteristics of the radiotelescope. D.L.G.

N73-32678 Joint Publications Research Service, Arlington, Va.
OPTICAL ACCUMULATION TIME IN SUPERLONG-BASELINE INTERFEROMETERS **c14**
L. R. Kogan *In its* Radioastronomy (JPRS-59985) 7 Sep. 1973 p 39-44 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), no. 5, 1973 p 707-711 (For availability see N73-32671 23-30)

It is pointed out that the basic factor which limits signal accumulation time of a superlong-baseline interferometer, is the frequency stability of the sinusoidal-signal generators which are used as heterodynes at the receiving points. The problem considered is that of determining an optimal signal accumulation time for the interferometer at which the signal-to-noise ratio is maximal. The results are presented of computing the optimal accumulation time as a function of the short-term stability of a heterodyne and of its frequency. D.L.G.

N73-32679# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).
ASTRONOMICAL EPHEMERIDES FOR 1974 [EFEMERIDES ASTRONOMICAS, 1974]
Jul. 1973 602 p In SPANISH
Avail: NTIS HC $32.25

The 1974 astronomical catalog is presented. The calendar, eclipses, and geocentric phenomena are shown. The ephemerides are tabulated for the sun, moon, planets, and selected stars. Transl. by F.O.S.

N73-32680*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 PROJECT. VOLUME 4: SCIENCE RESULTS
15 Jul. 1973 656 p refs
(Contract NAS7-100)
(NASA-CR-135530; JPL-TR-32-1550-Vol-4) Avail: NTIS HC $35.00 CSCL 03B

Scientific results derived from standard Mars missions and some preliminary interpretations of the data obtained from the extended Mariner 9 Mars probe, are reported. For individual titles, see N73-32681 through N73-32725.

N73-32681* Geological Survey, Flagstaff, Ariz.
AN OVERVIEW OF GEOLOGIC RESULTS FROM MARINER 9
Harold Masursky *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 1-19 refs Submitted for publication (For availability see N73-32680 23-30)
(Contract JPL-WO-8122)
CSCL 03B

A summary of Mariner 9 mission operations insofar as they affected acquisition of geologic data is reported. Selected results with a minimum of supporting evidence are presented to give the geologic highlights of the mission. Volcanic features, tectonic features, channels, polar features, eolian features, impact craters, and the geological history of Mars are outlined. G.G.

N73-32682* Geological Survey, Menlo Park, Calif.
A GENERALIZED GEOLOGIC MAP OF MARS
M. H. Carr, Harold Masursky, and R. S. Saunders (JPL) *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 21-26 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

A generalized geologic map of Mars has been constructed largely on the basis of differences in the topography of the surface. A number of topographic features on Mars whose form is highly diagnostic of their origin are shown. Of particular note are the shield volcanoes and lava plains. In some areas, the original features have been considerably modified by subsequent erosional and tectonic processes. These have not, however, resulted in homogenization of the planet's surface, but rather have emphasized its variegated character by leaving a charcteristic imprint in specific areas. The topography of the planet, therefore, lends itself well to remote geologic interpretation. Author

N73-32683* Geological Survey, Menlo Park, Calif.
WATER AND PROCESSES OF DEGRADATION IN THE MARTIAN LANDSCAPE
Daniel J. Milton *In* JPL Mariner Mars 1971 Proj., Vol. 4

15 Jul. 1973 p 27-42 refs Submitted for publication (For availability see N73-32680 23-30)
(Contract JPL-WO-8122)
CSCL 03B

It is shown that erosion has been active on Mars so that many of the surface landforms are products of degradation. Unlike earth, erosion has not been a universal process, but one areally restricted and intermittently active so that a landscape is the product of one or two cycles of erosion and large areas of essentially undisturbed primitive terrain; running water has been the principal agent of degradation. Many features on Mars are most easily explained by assuming running surface water at some time in the past; for a few features, running water is the only possible explanation. Author

N73-32684* Geological Survey, Menlo Park, Calif.
VOLCANISM ON MARS
Michael H. Carr *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 43-61 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

One of the earliest and most significant of the Mariner 9 results was the recognition of prominent volcanic features on Mars. The volcanic features have a markedly asymmetric distribution. The planet can be roughly divided into two hemispheres. One includes nearly all the central volcanic features and the sparsely cratered plains; the other, for the most part, is densely cratered terrain, superficially resembling the lunar highlands. Author

N73-32685* California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
MARS: TROUGHED TERRAIN
Robert P. Sharp *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 63-74 refs Submitted for publication (For availability see N73-32680 23-30)
(Contrib-2265) CSCL 03B

One of the spectacular revelations of the Mariner 9 pictures was the assemblage of huge troughs in the Tithonius Lacus-Coprates region of equatorial Mars. These features represent a significant phase in the planet's evolution, and their interpretation although necessarily highly speculative is justified by the potential for indicating something of the nature of surficial and internal conditions and processes of Mars. Author

N73-32686* California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
MARS: FRETTED AND CHAOTIC TERRAINS
Robert P. Sharp *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 75-88 refs Submitted for publication (For availability see N73-32680 23-30)
(Contrib-2264) CSCL 03B

Fretted Martian terrain is characterized by smooth, flat, lowland areas separated from a cratered upland by abrupt escarpments of complex planimetric configuration and a maximum estimated height approaching 1 to 2 km. It is the product of some unusual erosive or abstractive process that has created steep escarpments. Chaotic terrain differs from fretted terrain in having a rough floor topography featuring a haphazard jumble of large angular blocks, and by arc-shaped slump blocks on its bounding escarpments. Its existence has now been confirmed by Mariner 9 pictures, and the characteristics, location, and areal extent of chaotic terrain have been more accurately and completely defined. Author

N73-32687* Geological Survey, Menlo Park, Calif.
COMPARISON OF MARTIAN AND LUNAR MULTI-RINGED CIRCULAR BASINS
Don E. Wilhelms *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 89-102 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Many similarities between Martian and lunar multi-ringed basins are outlined. There is a similar relation between basin size and number of rings; the second ring seems to appear in the crater-basin continuum in roughly the same diameter range. The similarities are tentatively considered great enough to indicate that Martian and lunar basins were formed by the same process. Morphological and statistical studies of lunar basins have strongly indicated this process to be impact. Author

N73-32688* Planetary Science Inst., Tucson, Ariz.
MARTIAN CRATERING 4: MARINER 9 INITIAL ANALYSIS OF CRATERING CHRONOLOGY
William K. Hartmann *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 103-123 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Early analyses of cratering and other Martian surface properties that indicated extensive ancient erosion have been strongly supported by Mariner 9 data. By their great variations in density, these craters indicate a history of Martian erosion and crustal development intermediate between earth and the moon. Author

N73-32689* Geological Survey, Flagstaff, Ariz.
THE LATITUDINAL DISTRIBUTION OF A DEBRIS MANTLE ON THE MARTIAN SURFACE
L. A. Soderblom, T. J. Kreidler, and Harold Masursky *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 125-132 refs Submitted for publication (For availability see N73-32680 23-30)
(Contract JPL-WO-8122)
CSCL 03B

A relatively young mantling deposit of debris surrounds both Martian polar regions and extends toward the equator. This mantle apparently has been derived by wind erosion of sedimentary deposits in the polar regions, a process that is probably continuing now. The distribution of the mantle is not correlated with any particular terrain type for it has masked the small crater populations on young and old terrains alike. The paucity of small fresh craters at high latitudes can be directly attributed to the presence of this debris blanket. It is clear that extreme care should be exercised in using the populations of small craters to establish the chronology of the evolution of geologic provinces on Mars. Author

N73-32690* Geological Survey, Flagstaff, Ariz.
MARINER 9 EVIDENCE FOR WIND EROSION IN THE EQUATORIAL AND MID-LATITUDE REGIONS OF MARS
John F. McCauley *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 133-149 refs Submitted for publication (For availability see N73-32680 23-30)
(NASA Order W-12872; Contract JPL-WO-8122)
CSCL 03B

Evidence for extensive wind erosion principally in the equatorial and mid-latitude regions of Mars is presented and compared with selected erosional landforms from the coastal desert of Peru known to be of eolian origin. The evidence for widespread erosion on Mars prompted an examination of certain aspects of its wind regime that are thought to be significant geologically. Author

N73-32691* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EOLIAN DEPOSITS AND DUNES ON MARS
J. A. Cutts and R. S. U. Smith (Calif. Inst. of Tech., Pasadena) *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 151-169 refs Submitted for publication (For availability see N73-32680 23-30)
(Contrib-2353) CSCL 03B

Detailed analysis of the Mariner 9 pictures reveals that eolian activity is not only a superficial effect, but a surface process of profound importance in the geologic evolution of Mars. Moderate- and large-scale topographic features that may be attributed to wind erosion are described and latitudinal variations in crater morphology are interpreted in terms of eolian deposition and erosion in the mid-latitudes of Mars. Author

N73-32692* Cornell Univ., Ithaca, N.Y. Lab. for Planetary Studies.
SANDSTORMS AND EOLIAN EROSION ON MARS
Carl Sagan *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 171-178 refs Submitted for publication (For availability see N73-32680 23-30)
(Contract NAS1-9683; JPL-952487)

CSCL 03B

It is now apparent that windblown sand plays a major role in the Martian environment. The existence of great sand and dust storms implies the lateral transport of large quantities of material on Mars that provide a convenient mechanism for the filling of craters- an event directly implied both by crater frequency-diameter statistics, and by the appearance of Martian craters. Such fast moving sand particles, saltating close to the Martian surface, can produce by collision and subsequent abrasion significant erosion of the Martian terrain. Author

N73-32693* Cornell Univ., Ithaca, N.Y.
VARIABLE FEATURES ON MARS 2: MARINER 9 GLOBAL RESULTS
C. Sagan, J. Veverka, P. Fox, R. Dubisch, R. French, P. Gierasch, L. Quam (Stanford Univ.), J. Lederberg (Stanford Univ.), E. Levinthal (Stanford Univ.)10(Stanford Univ.), R. Tucker et al *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 179-217 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Mariner 9 observations of time variable Martian dark areas and semi-tone areas are commonly resolved into streaks and splotches caused by sand storm particles. Bright streaks are formed by the smaller particles and require exceptionally high velocities for their formation as compared with the more easily saltated larger particles in dark streak areas. G.G.

N73-32694* Geological Survey, Flagstaff, Ariz.
MARINER 9 OBSERVATIONS OF THE SURFACE OF MARS IN THE NORTH POLAR REGION
L. A. Soderblom, M. C. Malin (Calif. Inst. of Tech., Pasadena), B. C. Murray (Calif. Inst. of Tech., Pasadena), and J. A. Cutts (JPL) *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 219-234 refs Submitted for publication (For availability see N73-32680 23-30)
(Contract NAS7-100; JPL-WO-8122)
(Contrib-2249) CSCL 03B

The recession rate of the north polar cap, as monitored by Mariner 9, was not significantly different than has been observed from earth in the past. Thus, the dynamic planet-wide dust storm does not seem to have had a noticeable effect on the thickeness of the CO2 deposit which developed during the standard mission. The dominant role of local topography in controlling the configuration of the retreating cap is confirmed. At narrow-angle resolution the retreating frost has high-lighted topographic detail that may represent Martian polar eolian deposits. At wide angle resolution the topography of the smooth plains, rugged etch pitted terrain, and complex central polar deposits is emphasized by the frost. Author

N73-32695* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIND EROSION IN THE MARTIAN POLAR REGIONS
James A. Cutts *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 235-246 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Photographic evidence suggests that many topographic features of the polar regions of Mars may have been sculptured by wind action. In the case of the pitted terrain, this is established by relating the orientations of elongate basins and grooves to patterns of albedo markings that are generally accepted to be wind-formed. Small-scale flutes and other textures of laminated terrain recognized outside the perennial ice cap in the south polar region are also attributed to eolian action. Winds flowing off the polar cap and spiraling toward the west seem to be responsible. More speculatively the large-scale circumpolar features which underlie the residual polar caps may be related to wind erosion. Rotational motion localized on circular segments of the perennial frost deposits are proposed as a mechanism. Author

N73-32696* California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
MARS: SOUTH POLAR PITS AND ETCHED TERRAIN
Robert P. Sharp *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 247-257 refs Submitted for publication (For availability see N73-32680 23-30)
(Contrib-2266) CSCL 03B

Martian south polar pits and etched terrain attest to alternating episodes of eolian deposition and erosion. Sometimes the south polar area has served as a sump for the accumulation of airborne debris and associated particles of frozen volatiles. At other times, the wind patterns or wind effectiveness change, and the atmosphere begins to remove the blanket of material it has earlier spread over the south polar region. Author

N73-32697* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NATURE AND ORIGIN OF LAYERED DEPOSITS OF THE MARTIAN POLAR REGIONS
James A. Cutts *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 259-278 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Layered deposits in the Martian polar regions are interpreted as accumulations of dust derived from atmospheric suspensions. Depressed and eroded terrains of the equatorial region are considered to be the principal sources of dust. A depositional model based on polar precipitation of dust predicts the formation of a vast, dome-shaped, featureless plateau underlain by layered deposits and occupying most of the area of annual frost cover. The rates of accumulation of dust and water ice in the polar regions have been estimated on the basis of atmospheric conditions in the present era. The analysis indicates an accumulation time of about 500 x 1 million years for the layered deposits and the presence of significant quantities of water ice in the deposits beneath the perennial cap. Author

N73-32698* Cornell Univ., Ithaca, N.Y.
LIQUID CARBON DIOXIDE AND THE MARTIAN POLAR LAMINAE
Carl Sagan *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 279-281 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

One of the most important findings of the Mariner 9 mission was the existence of a set of apparent stacked layers in both the north and south polar regions of Mars. The total thickness of the laminated terrain is approximately several kilometers. Because the Martian atmosphere is composed largely of CO2 and because the frost point of CO2 is known to be reached in both polar regions, it has been assumed that the volatiles in the bright laminae are in appreciable part condensed CO2, although condensed H2O, and a CO2-H2O clathrate are also possible. As long as the ratio of CO2 to H2O is large, the physical properties will be dominated by the CO2. Author

N73-32699* Washington Univ., Seattle.
MARS ATMOSPHERE DURING THE MARINER 9 EXTENDED MISSION: TELEVISION RESULTS
C. B. Leovy, G. A. Briggs (JPL), and B. A. Smith (New Mex. State Univ.) *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 283-298 refs Submitted for publication (For availability see N73-32680 23-30)
(Grant NGR-48-002-073)
CSCL 03B

Data from the Mariner 9 extended mission provide a record of seasonally varying processes from mid-spring to early summer in the Northern Hemisphere of Mars. Atmospheric phenomena observed by the television cameras during this period are: (1) A faint shelf of brightness near 20 km in height; (2) condensate clouds over Hellas in the early morning, (3) wave clouds over the south polar region indicating strong west to east winds; (4) faint wave clouds over the north polar cap indicating northeast to southwest flow off the cap; and (5) clouds over the major vocanos and Tithonius Lacus which show remarkable repeatability, strong topographic control, and, in some cases, evidence for convective structure. Author

N73-32700* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC AND SURFACE PROPERTIES OF MARS OBTAINED BY INFRARED SPECTROSCOPY ON MARINER 9

B. Conrath, R. Curran, R. Hanel, V. Kunde, W. Maguire, J. Pearl, J. Pirraglia, J. Welker, and T. Burke *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 299-314 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

The infrared spectroscopy experiment on Mariner 9 obtained data over much of Mars. Interpretation of the thermal emission of Mars in terms of atmospheric temperatures, wind fields and dynamics, surface temperatures, surface pressure and topography, mineral composition, and minor atmospheric constituents including isotopic ratios, as well as a search for unexpected phenomena are reported. Author

N73-32701* California Univ., Los Angeles. Dept. of Planetary and Space Science.
PRELIMINARY REPORT ON INFRARED RADIOMETRIC MEASUREMENTS FROM MARINER 9
H. H. Kieffer, S. C. Chase (Santa Barbara Res. Center), E. Miner (JPL), G. Muench (Calif. Inst. of Tech., Pasadena), and G. Neugebauer *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 315-338 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

The results of the preliminary analysis of the Mariner 9 radiometer data are: (1) Gross thermal characteristics of Mars agreed qualitatively with those observed in 1969: (2) a dust storm changed the thermal picture of Mars radically with average dayside temperatures lower by about 20K than without the dust storm; (3) over large-scale physiographic visual features, no univocal correlation between albedo and thermal inertia seems to exist, and (4) surface particle sizes derived from observed thermal inertias vary between 0.006 cm and 0.5 cm. Author

N73-32702* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER 9 ULTRAVIOLET SPECTROMETER EXPERIMENT: AFTERNOON TERMINATOR OBSERVATIONS OF MARS
J. M. Ajello, A. L. Lane, C. W. Hord (Colo. Univ., Boulder), C. A. Barth (Colo. Univ., Boulder), and A. I. Stewart (Colo. Univ., Boulder) *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 339-353 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

It is possible to model the ultraviolet terminator observations of Mariner 9 either with a homogeneous atmosphere or with a scattering layer in addition to a homogeneous atmosphere. The characteristic shape of the twilight intensity variation is dependent on the latitude of observation. Observations north of 55N require a homogeneous model. Twilight measurements south of 55N indicate that a scattering layer may be a general Martian occurrence, at least in the evening. The day-to-day surveillance of the Martian terminator during the first 216 Mariner 9 revolutions indicates haze formation in the evening, and its continued presence until early morning is a daily occurrence in mid-latitudes up to 50N. Author

N73-32703* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
MARINER 9 ULTRAVIOLET SPECTROMETER EXPERIMENT: MARS ATOMIC OXYGEN 1304-ANGSTROM EMISSION c14
D. J. Strickland, A. Ian Stewart, Charles A. Barth, Charles W. Hord, and Author L. Lane *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 355-368 refs Submitted for publication Sponsored by NASA (For availability see N73-32680 23-30)
CSCL 14B

Selected results are presented for a considerable quantity of Mariner 9 1304-A data for the first 100 revolutions from both the bright limb and disk of Mars. The limb data suggest that the exospheric temperature is less than it was in 1969 when Mariners 6 and 7 encountered the planet. Similar (O) concentrations (0.5 to 1%) are derived for a temperature of about 300 K. Structure in the limb profiles below 200 km suggests the possibility that about 0.2 kR of the observed approximately 0.8 kR near 150 km is due to dissociative excitation of CO2. Significant differences in selected limb profiles suggest that local as well as random variations in (O) occur. Author

N73-32704* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
MARINER 9 ULTRAVIOLET SPECTROMETER EXPERIMENT: SEASONAL VARIATION OF OZONE ON MARS c14
Charles A. Barth, Charles W. Hord, A. Ian Stewart, Arthur L. Lane (JPL), Mary L. Dick, and Gail P. Anderson *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 369-372 refs Submitted for publication Sponsored by NASA (For availability see N73-32680 23-30)
CSCL 14B

On Mars, the Mariner observations show a twenty-fold variation in the amount of ozone, depending on the presence or absence of another minor constituent, water vapor, in the atmosphere. In the evolution of earth's primitive atmosphere, the formation of an ozone layer may have played an important role in the prebiotic chemistry that took place on the surface. The seasonal formation and disappearance of ozone in the contemporary Martian atmosphere may be of consequence in any prebiotic chemistry that may be occurring there. Author

N73-32705* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MARINER 9 TELEVISION OBSERVATIONS OF PHOBOS AND DEIMOS 2
J. B. Pollack, J. Veverka (Cornell Univ.), M. Noland (Cornell Univ.), C. Sagan (Cornell Univ.), T. C. Duxbury (JPL), C. H. Acton, Jr. (JPL), G. H. Born (JPL), W. K. Hartmann (Sci. Appl., Inc.), and B. A. Smith (New Mex. State Univ.) *In* JPL Mariner Mars 1971 Prop., Vol. 4 15 Jul. 1973 p 373-388 refs Submitted for publication (For availability see N73-32680 23-30)
(Contract JPL-952487)
CSCL 03B

The analysis of the Mariner 9 pictures of Phobos and Deimos includes corrections to the orbits of the satellites, an estimate of their principal axes, additional confirmation of their synchronous rotation, a search for new satellites, photometric evidence for the presence of a regolith, and a discussion of their internal structure. Author

N73-32706* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MARINER 9 CELESTIAL MECHANICS EXPERIMENT Status Report
Jack Lorell and Irwin I. Shapiro (MIT, Cambridge) *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 389-391 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

There are two main objectives in the Mars gravity field analysis. The first is to generate a picture of the gravity field which can be used in conjunction with other types of data to elucidate the interior, surface structure, and history of Mars. The second is to aid the orbit determination aspect of the relativity experiment. In an effort to extract from the data a Mars gravity model of reasonable fidelity, various spherical harmonic models have been made. A parallel effort using a surface mass representation involves the differentiation of Doppler residuals for acceleration contours. Author

N73-32707* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARS GRAVITY FIELD VIA THE SHORT DATA ARCS
W. L. Sjogren, J. Lorell, S. J. Reinbold, and R. N. Wimberly *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 393-400 refs (For availability see N73-32680 23-30)
CSCL 03B

Short arc reduction of satellite Mars tracking data shows that: (1) There is one large gravity high covering the region of Nix Olympica and the three peaks to the east (about 110 deg longitude). It has an amplitude of 50 milligals at 2200-km altitude and implies a surface mass anomaly times greater than any on earth; (2) there are no large negative gravity anomalies comparable to the positive; and (3) the large 3000-km canyon seems to originate in a gravity high and end in a gravity low. Author

N73-32708* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARS GRAVITY DERIVED FROM LONG-PERIOD MOTION OF MARINER 9

A. J. Ferrari and E. J. Christensen *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 401-406 refs (For availability see N73-32680 23-30)
CSCL 03B

The spherical harmonic coefficients in the gravity field of Mars are determined using a two stage filtering process. In the first stage, a weighted least squares orbit determination processor is applied to Mariner 9 Doppler tracking data to estimate Kepler elements and rates. In the second stage, the Kepler element rates are used as input to another weighted least squares processor that estimates gravity coefficients using the Lagrange perturbation equations. The novelty in this method is the fitting of element rates rather than the elements themselves. This procedure decouples the results from the effects of internal spacecraft dynamics. Author

N73-32709* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA ACQUISITION AND EDITING FOR THE CELESTIAL MECHANICS EXPERIMENT
W. L. Martin, A. I. Zygielbaum, J. W. Layland, and R. D. Reasenberg (MIT, Cambridge) *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 407-414 refs (For availability see N73-32680 23-30)
CSCL 05B

A radio tracking subsystem is reported in which the critical elements are the frequency standard and its distribution subsystem, as they ultimately limit the accuracy of both range and Doppler measurements. A rubidium vapor standard serves as the primary reference. After frequency multiplication to S-band and additional amplification, the carrier is transmitted to the spacecraft where a phase-locked receiver-transmitter system filters the signal, introduces a slight frequency shift, and retransmits it to the ground. Doppler is measured by comparing the received frequency with that being transmitted. Author

N73-32710* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF NORMAL POINTS FOR THE RELATIVITY TEST OF THE CELESTIAL MECHANICS EXPERIMENT
J. F. Jordan, R. K. Hylkema, and S. J. Reinbold *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 415-412 refs (For availability see N73-32680 23-30)
CSCL 03B

The relativity test is based on Mariner 9 tracking data acquired by the Deep Space Network. These data consist of two types of measurements: (1) two-way frequency difference (Doppler) measurements that are proportional to the tracking station-spacecraft range rate, and (2) signal round trip time-delay measurements that are proportional to the station-spacecraft range. A data compression scheme has been employed to alleviate accuracy and cost difficulties by (1) using the Doppler data to solve for the spacecraft orbit and to relate spacecraft position to the center of mass of Mars; and (2) combining this result with the station-spacecraft range measurements to obtain measurements of the Earth-Mars distance, called normal points, that contain all of the information pertinent to a detailed knowledge of the Earth-Mars motion. Author

N73-32711* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF THE RELATIVISTIC TIME DELAY FROM THE MARINER 9 SUPERIOR CONJUNCTION DATA Status Report
P. B. Esposito and S. J. Reinbold *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 423-430 refs (For availability see N73-32680 23-30)
CSCL 03B

The purpose of the analyses performed is to investigate the Mariner 9 superior conjunction range and Doppler data in order to determine the values for the relativity and solar corona time-delay parameters. This approach is complementary to the long arc normal point approach. The two methods of analysis differ insofar as: (1) This analysis investigates a much shorter arc of data. (2) This procedure deals directly with the Mariner 9 Doppler and range data; therefore it avoids the intermediate step involved in constructing pseudo-data. It is complementary to the reduction of the normal point data because it relies upon the generation of an Earth-Mars ephemeris, which is determined from the analysis of normal points as well as past optical and radar data. Author

N73-32712* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF THE RELATIVISTIC TIME DELAY FOR MARINER 9: A STATUS REPORT ON THE JPL ANALYSIS OF NORMAL POINTS
J. D. Anderson and E. K. Lau *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 431-451 refs (For availability see N73-32680 23-30)
CSCL 03B

The procedure which has been chosen to accomplish a reduction of the Mariner 9 tracking data makes use of Doppler data over relatively short arcs of about one to nine orbital revolutions to determine the orbit of the spacecraft about Mars. Next, with the knowledge of the Mars-centered orbit, it is possible to use the range data to the spacecraft to determine the distance between the center of earth and the center of Mars for each short interval of tracking data. These reduced range measurements between the centers of the two planets make up the basic data for the relativity test. Author

N73-32713* Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
TIME-DELAY TEST OF GENERAL RELATIVITY AND EARTH-MARS EPHEMERIS IMPROVEMENT FROM ANALYSIS OF MARINER 9 TRACKING DATA Status Report
Irwin I. Shapiro and Robert D. Reasenberg *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 453-464 refs (For availability see N73-32680 23-30)
CSCL 03A

Because of the large systematic errors that accompany the conversion of spacecraft ranging data to equivalent Earth-Mars time delays, the corresponding determination of gamma does not now allow the predictions of general relativity to be distinguished from those of the Brans-Dicke scalar-tensor theory with the fraction s of scalar field admixture being 0.06. The uncertainty in the determination of (1 plus gamma)/2 at the present stage of the Mariner 9 data analysis is at about the 10% level. The ephemeris of Mars suffers from the same problem: Only with the elimination of a major fraction of the systematic errors affecting the Mariner 9 pseudo observables will a truly substantial improvement be possible in the determination of the orbit. Author

N73-32714* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECT OF MARINER 9 NORMAL POINTS ON PLANETARY EPHEMERIDES
M. S. W. Keesey, J. H. Lieske, and E. M. Standish *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 465-470 refs (For availability see N73-32680 23-30)

A set of ephemerides due to Mariner 9 normal points was created and used in conjunction with radar range time delay measurements to improve the range residuals in planetary gravity field measurements. In addition to the ephemeris of Mars, the Mariner 9 spacecraft data have also affected the geocentric ephemeris of Venus, producing changes up to 5 km in range. G.G.

N73-32715* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLASMA COLUMN CHANGES AT SMALL SOLAR ELONGATIONS **c29**
P. S. Callahan *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 471-472 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

The differenced range versus integrated Doppler (DRVID) technique was used to study charged particle changes in the ray path between earth and Mariner 9. For plasma activity near the sun, DRVID data were obtained from August 10 to October 24, 1972, surrounding the Mariner 9 superior conjunction on September 7. If the records are viewed in terms of range change or range change rate, the day-to-day fluctuations in these quantities mask the changes expected due to the varying solar elongation. Thus, while the steady-state total electron content

varies by a factor of 4, the columnar content changes show no systematic variations. Author

N73-32716* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-BAND RADIO OCCULTATION MEASUREMENTS OF THE ATMOSPHERE AND TOPOGRAPHY OF MARS WITH MARINER 9: EXTENDED MISSION COVERAGE OF POLAR AND INTERMEDIATE LATITUDES
A. J. Kliore, G. Fjeldbo, B. L. Seidel, M. J. Sykes, and P. M. Woiceshyn *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 473-494 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Radio occultation measurements from Mariner 9 orbits around Mars show that the radius of Mars changes by only about 2 km from a latitude of 65 deg to the north pole, that the north polar area is about average in elevation, and that polar temperature profiles are indicative of the possibility that the remnant north polar cap may be at least partially composed of water ice. It is also found that Mars, in addition to being asymmetrical equatorially, is also significantly asymmetrical in the north and south direction with the Southern Hemisphere lying 3 to 4 km higher. Temperature gradients in the clear Martian atmosphere of only about one-half of the adiabatic gradients of 5 deg K/km suggest the importance of dynamical processes. G.G.

N73-32717* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPROXIMATIONS TO THE MEAN SURFACE OF MARS AND MARS ATMOSPHERE USING MARINER 9 OCCULTATIONS
D. L. Cain, A. J. Kliore, B. L. Seidel, M. J. Sykes, and P. M. Woiceshyn *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 495-498 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

When the Mariner 9 spacecraft passed behind Mars in its orbiting phase, the radio beam was cut off by some physical feature. These occultations occurred during the months of November and December 1971 and again in April and May 1972. The fairly good global spread of these data was used to estimate the shape of the Martian globe, as definable by mathematical shapes (ellipsoidal and spherical harmonic). The refraction profiles allowed the estimation of pressure near the occultation point; these, corrected back to an arbitrary fixed value of pressure, chosen to be 6.1 mb, were used as radii to an isobaric surface. Preliminary results showed a figure displacement from the mass center with a best fit southeast by 2.85 km. There was also an equatorial displacement in the direction of about 100 deg W. Atmospheric approximations for the mass center to 6.1-mb pressure distances were fit to an ellipsoid. Author

N73-32718* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VERIFICATION OF PERFORMANCE OF THE MARINER 9 TELEVISION CAMERAS c07
T. E. Thorpe *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 499-510 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 09F

Based on limited data, the Mariner 9 performance appears consistent throughout its mission. Several corrections have been provided by inflight verification sequences. A change in photometric response, which will impair precise photometric analysis, has been observed. Hence, only qualified photometric measurement appears feasible under limited conditions. Conversely, certain geometric and electronic parameters appear both measurable and congruent with preflight prediction. The role of inflight verification has been emphasized by these data to assess the in situ camera health and to promote efficient data analysis and interpretation. Author

N73-32719* RAND Corp., Santa Monica, Calif.
MARTIAN SURFACE COORDINATES
Merton E. Davies and David W. G. Arthur (Geological Survey, Flagstaff, Ariz.) *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 511-573 refs Submitted for publication (For availability see N73-32680 23-30)
(Contract JPL-953011; JPL-WO-8122)
CSCL 03B

The resolution of the pictures from the Mariner 9 mission determines the distribution of the control points, as well as the gaps in the planet-wide control net. After discussing the photogrammetric equations and the computational method used to establish the planet-wide control net and the secondary net, the camera stations and the assumed physical properties of Mars are considered. Subsequent paragraphs contain a description of the control points, their measurements, and a discussion of how distortions are removed. Finally, results of the computations are given, with tables of coordinates for the control points. Author

N73-32720* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER 9 AEROGRAPHIC COORDINATE SYSTEM
Gerald DeVaucouleurs (Texas Univ., Austin), Merton E. Davies (RAND Corp., Santa Monica, Calif.), and Francis M. Sturms, Jr. *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 575-585 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Preliminary Mariner 9 map products were based on computed aerocentric coordinates at the point where the optic path intercepts a spherical reference figure for Mars. The intercept point on a reference ellipsoid would in general have slightly different values of radius, latitude, and longitude. For near-vertical viewing used for mapping, these differences are on the order of 0.1 in latitude and longitude, which is negligible compared to the uncertainties of the initial uncontrolled mosaics and maps. Author

N73-32721* Geological Survey, Flagstaff, Ariz.
PHOTOGRAMMETRIC EVALUATION OF MARINER 9 PHOTOGRAPHY c14
S. S. C. Wu, F. J. Shafer, G. M. Nakata, Raymond Jordan, and K. R. Blasius (Calif. Inst. of Tech., Pasadena) *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 587-592 Submitted for publication (For availability see N73-32680 23-30)
CSCL 14E

Some attempts to produce, with an AP/C analytical plotter, stereo models using Mariner 9 pictures are reported. The first attempt using geometrically uncorrected mission test video system (MTVS) imagery failed; the second, using corrected reduced data record (RDR) pictures also failed, probably because they were reconstructed through a vidicon display which introduces additional distortion. By using images obtained from RDR tape data through the Optronics Photowrite device, models were successfully obtained. Author

N73-32722* California Inst. of Tech., Pasadena. Div. of Planetary and Geological Sciences.
A STUDY OF MARTIAN TOPOGRAPHY BY ANALYTIC PHOTOGRAMMETRY
Karl R. Blasius *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 593-608 refs Submitted for publication (For availability see N73-32680 23-30)
(Contrib-2250) CSCL 03B

The photogrammetric potential of Mariner 9 data is discussed and the analytically determined topography of certain Martian landforms is presented. Author

N73-32723* Geological Survey, Flagstaff, Ariz.
CARTOGRAPHIC PRODUCTS FROM THE MARINER 9 MISSION
R. M. Batson *In* JPL Mariner Mars 1973 Proj., Vol. 4 15 Jul. 1973 p 609-623 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

Simultaneous acquisition of geodetic, cartographic, geologic, and other scientific data on Mars from Mariner 9 required extensive modification of conventional methods of mapping. Preliminary evaluation of all data simultaneously generated an inordinately large number of interim cartographic products for a final cartographic atlas of Mars. The selection of the scales at which Mars would be mapped, the projections to be used, and the

way the planet would be divided into quadrangles was based on the resolution of Mariner 9 pictures and upon the resources available over the lifetime of the Mariner Mars 1971 Project.
Author

N73-32724* Texas Univ., Austin. Dept. of Astronomy.
PRELIMINARY ALBEDO MAP OF THE SOUTH POLAR REGION
Gerald DeVaucouleurs, James Roth, and Claire Mulholand *In* JPL Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 625-629 refs Submitted for publication (For availability see N73-32680 23-30)
CSCL 03B

A preliminary albedo map of the Martian south polar region in stereographic projection was prepared mainly from mission test video system (MTVS) prints before rectified and gridded prints were received, but some adjustments were made to conform with a semi-controlled photomosaic. Wherever possible, use also was made of crater coordinates. Two versions of the map are presented: one with a coordinate grid overlay and one without it. The precision of the coordinates is generally within 1 deg in latitude and the corresponding are in longitude. The maps show both the albedo markings and, with subdued contrast, the craters and topographic features that are necessary to locate the former. The map covers the range of latitudes from - 65 deg to the south pole.
Author

N73-32725* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXTENDED MISSION OPERATIONS SUMMARY, APPENDIX
M. E. Goble *In its* Mariner Mars 1971 Proj., Vol. 4 15 Jul. 1973 p 631-636 (For availability see N73-32680 23-30)
CSCL 22C

Mariner 9 orbital operations and extended mission events are discussed. Spacecraft observations for standard mapping and sun and earth occultations are outlined.
G.G.

N73-32726*# Kanner (Leo) Associates, Redwood City, Calif.
MUTUAL AID IN SPACE
K. A. Bushuyev Washington NASA Sep. 1973 16 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 4, 1973 p 6-15
(Contract NASw-2481)
(NASA-TT-F-15096) Avail: NTIS HC $3.00 CSCL 22A

Some details and problems are described of joint Soviet-American flight scheduled for July, 1975. Mutual aid and rescue in case of disaster is stressed. Three compatibility problems which must be solved before docking could be attempted are mentioned. These problems are: compatibilities of docking mechanisms, search and rendezvous means, and cabin atmosphere parameters. The docking technology of the Soviet spacecrafts Soyuz-5, Soyuz-4, Soyuz-11, and Salyut with their active-passive (male-female) docking mechanisms are described. A description of the androgenic (unisex) docking mechanism being designed for the Apollo-Soyuz rendezvous is also included.
Author

N73-32727*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PHYSICAL AND DYNAMICAL STUDIES OF METEORS
Richard B. Southworth and Zdenek Sekanina Washington NASA Oct. 1973 108 p refs
(Contract NAS1-11204)
(NASA-CR-2316) Avail: NTIS HC $4.25 CSCL 03B

Interplanetary distributions from a sample of 20,000 radar meteor observations are presented. These distributions are freed from all known selection effects with the exception of a possible bias against fragmenting meteors which has not yet been adequately assessed. These data thus represent the largest and most accurate collection of radar meteor distributions. Both general average distribution and the distribution of meteor streams with their comet and asteroid associations are presented. Sporadic space density and space density of meteor streams are also included.
Author

N73-32728*# California Univ., Santa Barbara. Dept. of Physics.
ON THE ESTABLISHMENT AND EVOLUTION OF ORBIT-ORBIT RESONANCES Ph.D. Thesis
Charles Finney Yoder Aug. 1973 150 p refs
(Grant NGR-05-010-062)
(NASA-CR-135674) Avail: NTIS HC $9.50 CSCL 03B

A theory which suggests that in the case of planetary satellites, a tidally induced torque acting on the satellites may play an essential role on the evolution of the observed resonances is investigated as it applies to the three resonances among pairs of satellites of Saturn. Three stages are investigated: a theoretical description of transition is developed for a simple time dependent pendulum plus constant applied torque; the two body gravitational interaction is expanded and reduced to a one dimensional time independent Hamiltonion; and the model is applied to Saturn resonances. Although the theory proves successful in the Saturn case, it is less successful in the Tital-Hyperion case in providing a reasonable time scale for the damping of the amplitude of liberation.
Author

N73-32729*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
STUDY 2.6 OPERATIONS ANALYSIS MISSION CHARACTERIZATION
R. R. Wolfe 15 Aug. 1973 103 p refs
(Contract NASw-2472)
(NASA-CR-135705; ATR-74(7336)-1) Avail: NTIS HC $7.25 CSCL 22A

An analysis of the current operations concepts of NASA and DoD is presented to determine if alternatives exist which may improve the utilization of resources. The final product is intended to show how sensitive these ground rules and design approaches are relative to the total cost of doing business. The results are comparative in nature, and assess one concept against another as opposed to establishing an absolute cost value for program requirements. An assessment of the mission characteristics is explained to clarify the intent, scope, and direction of this effort to improve the understanding of what is to be accomplished. The characterization of missions is oriented toward grouping missions which may offer potential economic benefits by reducing overall program costs. Program costs include design, development, testing, and engineering, recurring unit costs for logistic vehicles, payload costs. and direct operating costs.
Author

N73-32730*# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.
SPACE TUG GEOSYNCHRONOUS MISSION SIMULATION
T. J. Lang 29 Jun. 1973 25 p refs
(Contract NASw-2472)
(NASA-CR-135706; ATR-73(7336)-3) Avail: NTIS HC $3.25 CSCL 22A

Near-optimal three dimensional trajectories from a low earth park orbit inclined at 28.5 deg to a synchronous-equatorial mission orbit were developed for both the storable (thrust = 28,912 N (6,500 lbs), I sub sp = 339 sec) and cryogenic (thrust = 44,480 N (10,000 lbs), I sub sp = 470 sec) space tug using the iterative cost function minimization technique contained within the modularized vehicle simulation (MVS) program. The finite burn times, due to low thrust-to-weight ratios, and the associated gravity losses are accounted for in the trajectory simulation and optimization. The use of an ascent phasing orbit to achieve burnout in synchronous orbit at any longitude is investigated. The ascent phasing orbit is found to offer the additional advantage of significantly reducing the overall delta velocity by splitting the low altitude burn into two parts and thereby reducing gravity losses.
Author

N73-32731*# Stanford Univ., Calif. Inst. for Plasma Research.
THE MAGNETOSPHERIC STRUCTURE OF PULSARS
David H. Roberts Aug. 1973 127 p refs
(Grant NGL-05-020-272; NSF GP-23840)
(NASA-CR-135587; SUIPR-537) Avail: NTIS HC $8.50 CSCL 03B

A model of pulsar magnetospheres is described which has evolved inductively from the work of Sturrock, where the radiation is produced near the surface of a neutron star. Some of the theoretical ideas of others, particularly those of Sturrock, are discussed. The braking index n and period-pulse-width distribution

of pulsars are first reinvestigated by relaxing the conventional assumption that R sub Y = R sub L, where R sub Y is the radius of the neutral points marking the transition from closed to open magnetic field lines, and R sub L is the radius of the light cylinder. This is replaced by the parameterization R sub Y = R sub * (1- eta)power R sub L (eta), where R sub * is the neutron star radius. If the ratio frequency radiation is created near the surface and beamed along open field lines, it is found that a good fit to the period-pulse-width distribution can be obtained for eta in the range 0.5 = or < eta = or < 0.7. The relation n = 1 + 2 eta then gives n = 2.2 + or - 0.2, which is in good agreement with the values measured for the Crab pulsar. Author

N73-32732*# RAND Corp., Santa Monica, Calif.
MARTIAN SURFACE COORDINATES
Merton E. Davies and David W. G. Arthur (Geol. Survey, Flagstaff, Ariz.) Apr. 1973 98 p refs Submitted for publication Prepared for JPL
(Contract JPL-953011; USGS Order WO-8122)
(NASA-CR-135586; R-1252-JPL) Avail: NTIS HC $7.00 CSCL 03B

Methods and results are presented for primary and secondary triangulation of the Martian surface. The primary network is based on multiphotograph stereophotogrammetry in which the pictures are rotated around fixed centers; these centers are provided as spacecraft stations from the tracking data. The computations use the latest Mars spin axis determined by Mariner 9 experiments and the new first meridian passing through a small crater, Airy-O, seen on Mariner 9 imagery. The secondary triangulation is performed in the map plane using rectified pictures as map fragments, assumed to be of correct shape. Primary positions are given. Author

N73-32733*# URS/Matrix Co., Huntsville, Ala. Man Systems Div.
DEVELOPMENT OF FLIGHT EXPERIMENT WORK PERFORMANCE AND WORKSTATION INTERFACE REQUIREMENTS, PART 1. TECHNICAL REPORT AND APPENDICES A THROUGH G Final Report
Richard G. Hatterick 31 Aug. 1973 348 p refs
(Contract NAS8-28359)
(NASA-CR-124409; PRL-415-Pt-1) Avail: NTIS HC $19.50 CSCL 22A

A skill requirement definition method was applied to the problem of determining, at an early stage in system/mission definition, the skills required of on-orbit crew personnel whose activities will be related to the conduct or support of earth-orbital research. The experiment data base was selected from proposed experiments in NASA's earth orbital research and application investigation program as related to space shuttle missions, specifically those being considered for Sortie Lab. Concepts for two integrated workstation consoles for Sortie Lab experiment operations were developed, one each for earth observations and materials sciences payloads, utilizing a common supporting subsystems core console. A comprehensive data base of crew functions, operating environments, task dependencies, task-skills and occupational skills applicable to a representative cross section of earth orbital research experiments is presented. All data has been coded alphanumerically to permit efficient, low cost exercise and application of the data through automatic data processing in the future. Author

N73-32734*# Stanford Univ., Calif. Radioscience Lab.
RESEARCH AT THE STANFORD CENTER FOR RADAR ASTRONOMY Semiannual Status Report, 1 Jan. - 30 Jun. 1973
Jul. 1973 35 p refs
(Grant NGL-05-020-014; SEL Proj. 3208)
(NASA-CR-135670; SASR-21) Avail: NTIS HC $3.75 CSCL 03A

Theoretical and experimental radio and radar studies are presented concerning lunar and planetary atmospheres and surfaces; the sun and interplanetary medium; and software and hardware conceived while doing research. Emphasis is given to probe and radio acculation measurements of planetary atmospheres. A list is included of recent publications, technical and scientific reports, and symposia with papers. T.M.R.

N73-32735*# Dudley Observatory, Albany, N.Y.
FEASIBILITY STUDY FOR THE USE OF A YF-12 AIRCRAFT AS A SCIENTIFIC INSTRUMENT PLATFORM FOR OBSERVING THE 1970 SOLAR ECLIPSE Final Technical Report
Robert D. Mercer 18 Sep. 1973 284 p refs
(Grant NGR-33-011-009)
(NASA-CR-135482) Avail: NTIS HC $16.25 CSCL 03A

The scientific and engineering findings are presented of the feasibility study for the use of a YF-12 aircraft as a scientific instrument platform for observing the 1970 solar eclipse. Included in the report is the computer program documentation of the solar eclipse determination; summary data on SR-71A type aircraft capabilities and limitations as an observing platform for solar eclipses; and the recordings of an informal conference on observations of solar eclipses using SR-71A type aircraft. K.M.M.

N73-32736*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
OPERATIONS ANALYSIS (STUDY 2.6). VOLUME 4: COMPUTER SPECIFICATION; LOGISTICS OF ORBITING VEHICLE SERVICING (LOVES) Final Report
15 Sep. 1973 39 p refs
(Contract NASw-2472)
(NASA-CR-135709; ATR-74(7336)-3-Vol-4) Avail: NTIS HC $4.00 CSCL 22A

The logistics of orbital vehicle servicing computer specifications was developed and a number of alternatives to improve utilization of the space shuttle and the tug were investigated. Preliminary results indicate that space servicing offers a potential for reducing future operational and program costs over ground refurbishment of satellites. A computer code which could be developed to simulate space servicing is presented. Author

N73-32737*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MODEL OF THE PHYSICAL PROPERTIES OF COMET ENCKE
F. W. Taylor, C. M. Michaux, and R. L. Newburn, Jr. 1 Oct. 1973 38 p refs
(Contract NAS7-100)
(NASA-CR-135707; JPL-TR-32-1590) Avail: NTIS HC $4.00 CSCL 03B

The available observational data on periodic comet Encke were collected and interpreted in order to construct a model of the comet. The model is intended for use in the design of scientific experiments and spacecraft systems to be used on future missions to Encke. Numerical values and ranges of uncertainty are given for all of the important structural, compositional, and photometric parameters with references to the original research from which these were calculated or estimated. Author

N73-32738*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONTAMINATION ASSESSMENT AND CONTROL IN SCIENTIFIC SATELLITES
Robert J. Naumann Washington Oct. 1973 43 p refs
(NASA-TN-D-7433; M-459) Avail: NTIS HC $3.00 CSCL 06M

Techniques for assessment and control of the contamination environment for both particulates and condensible vapors in the vicinity of spacecraft are developed. An analysis of the deposition rate on critical surfaces is made considering sources within the line of sight of the surface in question as well as those obscured from the line of sight. The amount of contamination returned by collision with the surrounding atmosphere is estimated. Scattering and absorption from the induced atmosphere of gases and particulates around the spacecraft are estimated. Finally, design techniques developed for Skylab to reduce the contamination environment to an acceptable level are discussed. Author

N73-32739*# Research Triangle Inst., Research Triangle Park, N.C.
STUDY OF METEOROID DETECTION SYSTEMS APPLICABLE TO THE OUTER PLANETS MISSIONS
A. D. Brooks, C. D. Parker, and L. K. Monteith (North Carolina State Univ.) [1973] 98 p refs
(Contract NAS1-11692)

(NASA-CR-132310) Avail: NTIS HC $7.00 CSCL 03B

Modifications to the Pioneer 10/11 meteoroid detection experiment to allow it to be used for outer planet missions were investigated. Both pressurized cells and metal-oxide silicon (MOS) penetration detectors are considered. Both the sensors systems and the electronics are treated. Investigation of the calibration and characterization of the MOS penetration detector is reported. Author

N73-32740*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF TERRESTRIAL RESOURCES BY SPACE OBJECTS AND INTERNATIONAL LAW
Marco G. Marcoff Washington NASA Oct. 1973 11 p refs Transl. into ENGLISH from Rev. Gen. de l'Air et de l'Espace (France), v. 35, no. 4, 1972 p 343-348
(Contract NASw-2481)
(NASA-TT-F-15094) Avail: NTIS HC @3.00 CSCL 03B

The teleobservation and surveillance of the surface of the earth by satellite cannot limit itself solely to the geographical confines of the state or states which have authorized the activity, or who are participating in the experiments. In regard to risks of international disputes arising from space prospecting of terrestrial resources, even if carried out with the consent of certain states, and taking account of the contradictory interests of the economic and military establishments implied in this type of activity, it is to be hoped that the judicial subcommittee of the U.N. will not delay in initiating appropriate international procedures. Author

N73-32741*# TRW Systems Group, Redondo Beach, Calif. Electronic Systems Engineering Dept.
ASTP RANGING SYSTEM MATHEMATICAL MODEL Final Report
M. R. Ellis and L. H. Robinson 4 Oct. 1973 123 p refs
(Contract NAS9-13296)
(NASA-CR-134063; TRW-24339-H005-R0-00) Avail: NTIS HC $8.25 CSCL 22C

A mathematical model is presented of the VHF ranging system to analyze the performance of the Apollo-Soyuz test project (ASTP). The system was adapted for use in the ASTP. The ranging system mathematical model is presented in block diagram form, and a brief description of the overall model is also included. A procedure for implementing the math model is presented along with a discussion of the validation of the math model and the overall summary and conclusions of the study effort. Detailed appendices of the five study tasks are presented: early late gate model development, unlock probability development, system error model development, probability of acquisition and model development, and math model validation testing. Author

N73-32742*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALGEBRAICALLY SPECIAL SPACE-TIME IN RELATIVITY, BLACK HOLES, AND PULSAR MODELS
Ronald J. Adler and Charles Sheffield Aug. 1973 107 p refs Prepared in cooperation with Earthsat Corp., Washington, D. C.
(NASA-TM-X-62298) Avail: NTIS HC $7.50 CSCL 03A

The entire field of astronomy is in very rapid flux, and at the center of interest are problems relating to the very dense, rotating, neutron stars observed as pulsars. the hypothesized collapsed remains of stars known as black holes, and quasars. Degenerate metric form, or Kerr-Schild metric form, was used to study several problems related to intense gravitational fields. Author

N73-32743*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ESTIMATES OF THE MOON'S GEOMETRY USING LUNAR ORBITER IMAGERY AND APOLLO LASER ALTIMETER DATA
Ruben L. Jones Oct. 1973 60 p refs
(NASA-TR-R-407; L-8797) Avail: NTIS HC $3.50 CSCL 03B

Selenographic coordinates for about 6000 lunar points identified on the Lunar Orbiter photographs are tabulated and have been combined with those lunar radii derived from the Apollo 15 laser altimeter data. These coordinates were used to derive that triaxial ellipsoid which best fits the moon's irregular surface. Fits were obtaind for different constraints on both the axial orientations and the displacement of the center of the ellipsoid. The semiaxes for the unconstrained ellipsoid were a = 1737.6 km, b = 1735.6 km, and c = 1735.0 km which correspond to a mean radius of about 1736.1 km. These axes were found to be nearly parallel to the moon's principal axes of inertia, and the origin was displaced about 2.0 km from the moon's center of gravity in a direction away from the earth and to the south of the lunar equator. Author

N73-32744# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 309
1 Oct. 1973 114 p refs Transl. into ENGLISH from various Soviet articles
(JPRS-60165) Avail: NTIS HC $7.75

Articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics. Details of Soviet space events are included. Author

N73-32745*# Martin Marietta Corp., Denver, Colo.
BALLISTIC MODE MERCURY ORBITER MISSION OPPORTUNITY HANDBOOK
G. R. Hollenbeck, D. G. Roos, and P. S. Lewis Washington NASA Aug. 1973 129 p
(Contract NAS2-7268)
(NASA-CR-2298) Avail: NTIS HC $4.50 CSCL 22A

Significant payloads in Mercury orbit can be achieved through use of high-thrust, chemical propulsion systems on ballistic trajectories. Interplanetary trajectory characteristics are presented, for Venus swingbys to Mercury, were multiple revolutions about the sun are allowed on each leg to provide low energy mission in 1977, 1980, 1985 and 1988. Guidance and navigation results are shown for each opportunity. Additionally, the use of midcourse maneuvers and multiple Venus swingbys are explored as means of further reducing the energy requirements. Author

N73-32746# Konkoly Observatory, Budapest (Hungary).
A STUDY OF SOME VARIABLE STARS IN MESSIER 3
B. Szeidl 1973 31 p refs
(Rept-63) Avail: NTIS HC $3.75

All known RR Lyrae type variable stars in Messier 3 which were left out of attention in an earlier study were measured or estimated. The comparison stars were selected from Sandage's primary photoelectric and secondary photographic sequence. Magnitudes for the variables are given in a table. Elaboration of the observational material and the determination of the epochs is presented along with the periods and normal points. Author

N73-32747# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
PROGRAMS FOR ASTROPHYSICAL EXPERIMENT PROCESSING [PROGRAMMES DESTINES AU DEPOUILLEMENT DES EXPERIENCES D'ASTROPHYSIQUE]
J. C. Gonin and A. Rabearivelo 1972 51 p refs In FRENCH
(CALC-01-72) Avail: NTIS HC $4.75

IBM 1130 computers for astrophysical data processing are presented. Decimal-hexadecimal conversion routines for arcs and hours, angular rotation routines, equatorial, ecliptical galactic change of reference frame routines, optical simulation including Schmidt plates with Kerber profiles, quadrics, toruses, plane and concave gratings, curve fitting, and products of functions are described. Most of the programs use extended precision floating point arithmetics. ESRO

N73-32748# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
ESTIMATION OF UNMODELED FORCE ON A LUNAR SATELLITE
B. D. Tapley and B. E. Schultz Oct. 1972 36 p refs Presented at the 23d Congr. of the Intern. Astronaut. Federation, Vienna, 8-15 Oct. 1972
(Grant AF-AFOSR-2233-72; AF Proj. 9769)
(AD-765151; AFOSR-73-1438TR) Avail: NTIS CSCL 22/3

In previous investigations, a sequential estimation procedure for estimating the state of a lunar orbiting space vehicle acted upon by unmodeled terms in the lunar potential and unmodeled mechanical forces such as those due to venting has been

developed. The unmodeled accelerations are approximated by a first-order Gauss-Markov process. The estimation algorithm gives an estimate of the position and velocity of the space vehicle as well as the components of the unmodeled acceleration at each observation epoch. The results obtained by processing real-time tracking data from the Apollo 10, 11, and 15 missions have indicated that the algorithm provides more precise estimates of the vehicle state than conventional orbit determination procedures and, hence, provides accurate input for navigation or guidance purposes. The question of the usefulness of the unmodeled accelerations for scientific experiments has not been established. (Modified author abstract) GRA

N73-32838* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SATURN SATELLITE ENCOUNTER OPPORTUNITIES FOR MARINER JUPITER-SATURN 1977
R. A. Wallace *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 14-25 refs (For availability see N73-32836 23-34) CSCL 22A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-32749* National Aeronautics and Space Administration. Pasadena Office, Calif.
EXPANDABLE SPACE FRAMES Patent
Alan H. Schoen, inventor (to NASA) Issued 11 Sep. 1973 9 p Filed 17 Dec. 1970 Supersedes N71-28948 (09 - 16, p 2683)
(NASA-Case-ERC-10365-1; US-Patent-3,757,476;
US-Patent-Appl-SN-99198; US-Patent-Class-52-646;
US-Patent-Class-52-64; US-Patent-Class-52-80;
US-Patent-Class-52-109; US-Patent-Class-287-92) Avail: US Patent Office CSCL 22B

Expandable space frames having essentially infinite periodicity limited only by practical considerations, are described. Each expandable space frame comprises a plurality of hinge joint assemblies having arms that extend outwardly in predetermined symmetrically related directions from a central or vertex point. The outer ends of the arms form one part of a hinge point. The outer expandable space frame also comprises a plurality of struts. The outer ends of the struts from the other part of the hinged joint. The struts interconnect the plurality of hinge point in sychronism, the spaceframes can be expanded or collapsed. Three-dimensional as well as two-dimensional spaceframes of this general nature are described.
Official Gazette of the U.S. Patent Office

N73-32750* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE VEHICLE WITH ARTIFICIAL GRAVITY AND EARTH-LIKE ENVIRONMENT Patent
Vernon H. Gray, inventor (to NASA) Issued 31 Jul. 1973 6 p Filed 30 Aug. 1971 Supersedes N72-11793 (10 - 02, p 0256)
(NASA-Case-LEW-11101-1; US-Patent-3,749,332;
US-Patent-Appl-SN-175983; US-Patent-Class-244-1SC;
US-Patent-Class-47-1.4; US-Patent-Class-47-17;
US-Patent-Class-244-1SS) Avail: US Patent Office CSCL 22B

A space vehicle adapted to provide an artificial gravity and earthlike atmospheric environment for occupants is disclosed. The vehicle comprises a cylindrically shaped, hollow pressure-tight body, one end of which is tapered from the largest diameter of the body, the other end is flat and transparent to sunlight. The vehicle is provided with thrust means which rotates the body about its longitudinal axis, generating an artificial gravity effect upon the interior walls of the body due to centrifugal forces. The walls of the tapered end of the body are maintained at a temperature below the dew point of water vapor in the body and lower than the temperature near the transparent end of the body. The controlled environment and sunlight permits an earth like environment to be maintained wherein the CO_2/O_2 is balanced, and food for the travelers is supplied through a natural system of plant life grown on spacecraft walls where soil is located. Official Gazette of the U.S. Patent Office

N73-32751 Houston Univ., Tex.
ON THE RICCATI CONTROLLED TERMINAL LANDING OF UNPOWERED LIFTING VEHICLES Ph.D. Thesis
Surjit Singh Grewal 1972 130 p
Avail: Univ. Microfilms Order No. 73-15730

A Riccati controlled feedback scheme is developed for guiding a spacecraft during the unpowered terminal phase of flight. A three section nominal trajectory is generated using backward integration. By assuming that the rate of change of velocity with respect to altitude is constant and that the rate of change of flight path angle is negligible the number of system state variables is reduced. The reduced system is then linearized by taking first order perturbations about a three section nominal trajectory. A linear feedback guidance law is developed by selecting a performance index which is quadratic in both the terminal state variable errors and the enroute control variable deviations. The minimization of this performance index leads to a third-order matrix Riccati equation. The solution of this matrix Riccati equation yields the optimal feedback gains. Dissert. Abstr.

N73-32752 Purdue Univ., Lafayette, Ind.
FORCES AND TORQUES ON SATELLITES MOVING THROUGH RAREFIED PLASMAS Ph.D. Thesis
Neil Wayne Haars 1972 137 p
Avail: Univ. Microfilms Order No. 73-15810

A plasmawith infinite conductivity is assumed and the linearized momentum equation and Maxwell's equations are applied to cylindrical satellites carrying constant or variable current. It is shown that there is a transverse disturbance (Alfven wave) which propagates long distances along lines slightly inclined to the terrestrial magnetic field lines. The field strength of the disturbance is dependent on the skin thickness of the satellite and is restricted to propagate in a zone equal to satellite planform. The expression for the propagating magnetic field and the ambient magnetic field contribution is used in an energy density integral to calculate the total magnetic energy carried away from the satellite by the Alfven wave. The wave drag is generally two orders of magnitude less than the induction force. At high altitudes the induction force is the primary energy drain from the satellite and the photoelectric effect can have a significant effect on this force. Dissert. Abstr.

N73-32753# Royal Aircraft Establishment, Farnborough (England).
SPACE VEHICLES LAUNCHED BETWEEN JANUARY AND AUGUST 1973
J. A. Pilkington Jul. 1973 7 p
(Tech-Memo-Space-199) Avail: NTIS HC $3.00

A listing of all space vehicles launched between January and August 1973 is presented along with amendments to a previous listing of vehicles launched before 31 December 1972. K.M.M.

N73-32754# Communications Research Centre, Ottawa (Ontario).
COMMUNICATIONS TECHNOLOGY SATELLITE
May 1973 16 p Revised
(CRC-Ser-Doc-06-RI/PS-3/1/72) Avail: NTIS HC $3.00

Features of the Communications Technology Satellite are described along with the major planned experiments. The launch procedure, attitude control procedures, array deployment, and spacecraft specification are discussed. F.O.S.

N73-32755# Joint Publications Research Service, Arlington, Va.
CONTROL IN SPACE
2 Oct. 1973 40 p refs Transl. into ENGLISH of the book "Upravleniye v Kosmose" vols. 1 and 2, Moscow, Izdatelstvo Nauka, 1971 29 p
(JPRS-60179) Avail: NTIS HC $4.00

Three Soviet articles concerning the design of control systems

for spacecraft are presented. The designs considered include: (1) an orientation system used with Molniya-1 communications satellite, (2) an automated monitoring system for reliability of onboard computers, and (3) an optimal control system for nuclear power plants and power supplies onboard spacecraft. For individual titles, see N73-32756 through N73-32758.

N73-32756 Joint Publications Research Service, Arlington, Va.
ORIENTATION SYSTEM FOR THE MOLNIYA-1 COMMUNICATIONS SATELLITE
B. V. Raushenbakh and Ye. N. Tokar *In its* Control in Space (JPRS-60179) 2 Oct. 1973 p 1-10 Transl. into ENGLISH of the book "Upravleniye v Kosmose" v. 1, Moscow, Izdatelstvo Nauka, 1972 p 144-151 (For availability see N73-32755 23-31)

The design and operation are described of a three-axis orientation system utilizing a power gyroscope. The unique feature of the system is the multipurpose use of the gyroscope which operates in the two-component angular velocity sensor mode. The gyroscope is used to damp the satellite oscillations with respect to the Ox and Oy axes, produce stabilizing moments with respect to the same axes (memory mode), and create control moments with respect to the Oz axes in the antenna orientation mode. Application of the gyroscope has made it possible to obtain control with respect to three axes, using only one rotating mass. The flight operation and maintenance of the Molniya-1 has confirmed the correctness of the principles employed in the orientation system. D.L.G.

N73-32757 Joint Publications Research Service, Arlington, Va.
AUTOMATED MONITORING OF THE RELIABILITY OF ONBOARD COMPUTERS AND SIMULATION OF A PROBLEM USING MARKOV PROCESSES NONUNIFORM IN TIME
I. Benesh *In its* Control in Space (JPRS-60179) 2 Oct. 1973 p 11-22 refs Transl. into ENGLISH of the book "Upravleniye v Kosmose" v. 2, Moscow, Izdatelstvo Nauka, 1972 p 139-148 (For availability see N73-32755 23-31)

An automated reliability monitoring system for an onboard computer using adaptive decision elements is considered. The adaptive decision elements operate by comparing the output signal with binary inputs, and they form the automated control system for the complex structure, based on a set of weight coefficients. It is proposed that the adaptive elements then be used to detect the functional modules with a decreased reliability level. The information about the relative failure rate of the various modules is input as the variables of state into the central shaper which automatically insures a given level of reliability by commuting the reserve modules. A problem involving failure of the functioning modules is considered, and various repair strategies are described based on the concept of a Markov process which is nonuniform in time. D.L.G.

N73-32758 Joint Publications Research Service, Arlington, Va.
SYNTHESIS OF OPTIMAL CONTROL SYSTEMS FOR NUCLEAR POWER PLANTS AND POWER SUPPLIES ABOARD SPACECRAFT c22
V. A. Bodner, V. V. Bugrovskiy, S. S. Kaniovskiy, T. S. Martyanova, B. N. Petrov, Yu. A. Ryazanov, G. M. Ulanov, and A. A. Shevyakov *In its* Control in Space (JPRS-60179) 2 Oct. 1973 p 23-37 Transl. into ENGLISH of the book "Upravleniye v Kosmose" v. 2, Moscow, Izdatelstvo Nauka, 1972 p 277-288 (For availability see N73-32755 23-31)

An optimal control system is considered for the case of a combined nuclear rocket power plant, including a low-thrust rocket engine for making the required maneuvers by the spacecraft, and a nuclear power plant which uses the thermal energy of the reactor to supply electric power to the spacecraft. As a result of different operating conditions of the nuclear rocket engine and power plant, the control system is required to employ various control laws and means of utilizing the different regulatable variables. The design is described of a single complex automted control system using an onboard computer and a standard optimal mathematical model. D.L.G.

N73-32759*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EFFECT OF FINITE THRUST AND HEATING CONSTRAINTS ON THE SYNERGETIC PLANE CHANGE MANEUVER FOR A SPACE SHUTTLE ORBITER-CLASS VEHICLE
E. D. Dickmanns Washington Oct. 1973 45 p refs
(NASA-TN-D-7211; M-105) Avail: NTIS HC $3.00 CSCL 22B

Numerical solutions to the optimal three-dimensional glide/thrust atmosphere skip maneuver are obtained using the multiple shooting iteration scheme. A singular thrust arc, induced by the heating constraints, is encountered. The synergetic plane change maneuver is shown to be superior to an extra-atmospheric one for 556-km (300-nm) circular orbit plane changes of more than 5 degrees. Author

N73-32760*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATION OF AN EXPERIMENT POINTING SYSTEM FOR THE SPACE SHUTTLE
P. D. Nicaise Sep. 1973 54 p refs
(NASA-TM-X-64779) Avail: NTIS HC $4.75 CSCL 22B

The pointing and control of experiments during sortie missions are examined from the standpoint of accuracy and performance. The effect of gimbal characteristics, pallet stiffness, and variation in the servo control loop are described. Simulation results are shown for a number of pointing options under the disturbing influences of man motion, thruster firings, and experiment operations. One option of particular interest is the suspended pallet which offers the possibility of high accuracy pointing of very large payloads without using conventional gimbals. The pallet is suspended within the payload bay by nonrigid attachments such as springs, thereby isolating experiments from most shuttle disturbances. Control moment gyros apply torques directly to the pallet to maintain pointing accuracy within the arc second range. Spring torques constrain shuttle attitude so thruster operation is not required. The suspended pallet approach will meet the base stability requirements of any sortie experiment and offers the possibility of a standardized low weight, low cost alternative to gimbaled mounts. Author

N73-32761*# E-Systems, Salt Lake City, Utah. Engineering Dept.
OMNI-AXIS SECONDARY INJECTION THRUST VECTOR CONTROL SYSTEM Technical Report, 29 Jun. 1972 - 29 Jun. 1973
D. J. Kirkley 18 Jul. 1973 180 p refs
(Contract NAS8-28887)
(NASA-CR-124428) Avail: NTIS HC $11.00 CSCL 22B

The concept, development, design study and preliminary analysis and layout of the required digital logic scheme to be used for injection valve control are presented. An application and optimization study of an Omni-Axis Secondary Injection Control System applicable to the proposed Space Shuttle Pressure Fed Engine is reported. Technical definition and analysis control procedures and test routines, as well as a supporting set of drawing sketches and reference manual, are enclosed. Author

N73-32762*# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
A STUDY OF NUMERICAL METHODS OF SOLUTION OF THE EQUATIONS OF MOTION OF A CONTROLLED SATELLITE UNDER THE INFLUENCE OF GRAVITY GRADIENT TORQUE
Joe F. Thompson, John C. McWhorter, Shahid A. Siddiqi, and Samuel P. Shanks Jul. 1973 186 p refs
(Contract NAS8-28833)
(NASA-CR-124416; EIRS-ASE-74-1) Avail: NTIS HC $11.50 CSCL 22C

Numerical methods of integration of the equations of motion of a controlled satellite under the influence of gravity-gradient torque are considered. The results of computer experimentation using a number of Runge-Kutta, multi-step, and extrapolation methods for the numerical integration of this differential system are presented, and particularly efficient methods are noted. A large bibliography of numerical methods for initial value problems for ordinary differential equations is presented, and a compilation of Runge-Kutta and multistep formulas is given. Less common numerical integration techniques from the literature are noted for further consideration. Author

N73-32763*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
UNSTEADY AERODYNAMIC ANALYSIS OF SPACE SHUTTLE VEHICLES. PART 1: SUMMARY REPORT Final Technical Report
Lars E. Ericsson and J. Peter Reding Aug. 1973 79 p refs
(Contract NAS8-28130)
(NASA-CR-124424; LMSC-D352230) Avail: NTIS HC $6.00 CSCL 22B

An analysis of the unsteady aerodynamics of space shuttle vehicles was performed. The results show that slender wing theory can be modified to give the potential flow static and dynamic characteristics over a large Mach number range from M = 0 to M > 1. A semi-empirical analytic approximation is derived for the loads induced by the leading edge vortex; and it is shown that the developed analytic technique gives good prediction of experimentally determined steady and unsteady delta wing aerodynamics, including the effects of leading edge roundness. At supersonic speeds, attached leading edge flow is established and shock-induced flow separation effects become of concern. Analysis of experimental results for a variety of boost configurations led to a definition of the main features of the flow interference effects between orbiter (delta wing) and booster. The effects of control deflection on the unsteady aerodynamics of the delta-wing orbiter were also evaluated. Author

N73-32764*# Boeing Co., Seattle, Wash. Launch Vehicle Branch.
EVALUATION OF MSFC-STD-486, "THREADED FASTENERS, TORQUE LIMITS FOR" FOR USE IN THE CONSTRUCTION OF AEROSPACE VHICLES
J. F. Hart 8 Jul. 1973 291 p
(Contract NAS8-5608)
(NASA-CR-124415; T5-6785-5) Avail: NTIS HC $16.75 CSCL 22B

MSFC-STD-486, Threaded Fasteners, Torque Limits For, is a relatively new standard that has not had much user experience. This test was run to provide such experience and verify the values in MSFC-STD-486. This was accomplished by plotting torque-tension curves on aluminum and alloy steel aircraft quality bolts and nuts through 1/2 inch in diameter. Author

N73-32765*# General Dynamics/Convair, San Diego, Calif.
LIFE SCIENCES PAYLOAD DEFINITION AND INTEGRATION STUDY, TASK C AND D. VOLUME 1: MANAGEMENT SUMMARY
Aug. 1973 56 p 4 Vol.
(Contract NAS8-29150)
(NASA-CR-124411; CASD-NAS73-003-Vol-1) Avail: NTIS HC $3.50 CSCL 14B

The findings of a study to define the required payloads for conducting life science experiments in space are presented. The primary objectives of the study are: (1) identify research functions to be performed aboard life sciences spacecraft laboratories and necessary equipment, (2) develop conceptual designs of potential payloads, (3) integrate selected laboratory designs with space shuttle configurations, and (4) establish cost analysis of preliminary program planning. Author

N73-32766*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
LIFE SCIENCES PAYLOAD DEFINITION AND INTEGRATION STUDY, TASK C AND D. VOLUME 2: PAYLOAD DEFINITION, INTEGRATION, AND PLANNING STUDIES
Aug. 1973 132 p refs
(Contract NAS8-29150)
(NASA-CR-124412; CASD-NAS73-003-Vol-2) Avail: NTIS HC $8.75 CSCL 14B

The Life Sciences Payload Definition and Integration Study was composed of four major tasks. Tasks A and B, the laboratory definition phase, were the subject of prior NASA study. The laboratory definition phase included the establishment of research functions, equipment definitions, and conceptual baseline laboratory designs. These baseline laboratories were designated as Maxi-Nom, Mini-30, and Mini-7. The outputs of Tasks A and B were used by the NASA Life Sciences Payload Integration Team to establish guidelines for Tasks C and D, the laboratory integration phase of the study. A brief review of Tasks A and B is presented provide background continuity. The tasks C and D effort is the subject of this report. The Task C effort stressed the integration of the NASA selected laboratory designs with the shuttle sortie module. The Task D effort updated and developed costs that could be used by NASA for preliminary program planning. Author

N73-32767*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
LIFE SCIENCE PAYLOAD DEFINITION AND INTEGRATION STUDY, TASK C AND D. VOLUME 3: APPENDICES
Aug. 1973 302 p
(Contract NAS8-29150)
(NASA-CR-124414; CASD-NAS73-003-Vol-3) Avail: NTIS HC $17.25 CSCL 14B

Research equipment requirements were based on the Mini-7 and Mini-30 laboratory concepts defined in Tasks A and B of the intial LSPD contract. Modified versions of these laboratories and the research equipment within them were to be used in three missions of Shuttle/Sortie Module. These were designated (1) the shared 7-day laboratory (a mission with the life sciences laboratory sharing the sortie module with another scientific laboratory), (2) the dedicated 7-day laboratory (full use of the sortie module), and (3) the dedicated 30-day laboratory (full sortie module use with a 30-day mission duration). In defining the research equipment requirements of these laboratories, the equipment was grouped according to its function, and equipment unit data packages were prepared. Author

N73-32768*# General Dynamics/Convair, San Diego, Calif.
LIFE SCIENCES PAYLOAD DEFINITION AND INTEGRATION STUDY, TASK C AND D. VOLUME 4: PRELIMINARY EQUIPMENT ITEM SPECIFICATION CATALOG
Aug. 1973 377 p refs 4 Vol.
(Contract NAS8-29150)
(NASA-CR-124413; CASD-NAS73-003-Vol-4) Avail: NTIS HC $21.00 CSCL 14B

A specification catalog to define the equipment to be used for conducting life sciences experiments in a space laboratory is presented. The specification sheets list the purpose of the equipment item, and any specific technical requirements which can be identified. The status of similar hardware for ground use is stated with comments regarding modifications required to achieve spaceflight qualified hardware. Pertinent sketches, commercial catalog sheets, or drawings of the applicable equipment are included. Author

N73-32769*# Radiation, Inc., Melbourne, Fla.
REMOTE PLATFORM POWER CONSERVING SYSTEM Patent Application
Charles W. Kurvin, inventor (to NASA) Filed 31 Aug. 1973 19 p Sponsored by NASA
(NASA-Case-GSC-11182-1; US-Patent-Appl-SN-393527) Avail: NTIS HC $3.00 CSCL 22B

The development of an unattended instrumented data collection platform for deployment to surfaces of planets is discussed. The instrument platform would be interrogated by unmanned satellites in polar orbit to obtain the collected data. A method for conserving the batteries which are used to power the transmitter and receiver on the platform is proposed. The system uses a timing device for generating time windows in synchronization with the spin and with the orbit in combination with a method for turning the platform receiver on at the appropriate intersection of the time windows. NASA

N73-32770*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
AERODYNAMIC CHARACTERISTICS OF LOCKHEED DELTA-BODY ORBITER AND STAGE-AND-ONE-HALF LAUNCH VEHICLE
Fred A. Velligan and H. O. Svendsen 29 Apr. 1971 108 p refs
(Contract NAS8-26362)
(NASA-CR-124419; LMSC-A989204; ACS-126) Avail: NTIS HC $7.50 CSCL 22B

An experimental wind tunnel test program was conducted to investigate the subsonic through high supersonic aerodynamic characteristics of the Lockheed delta lifting body orbiter and

stage-and-one-half launch vehicle. Analyses and results of these data are presented. A 0.01-scale model of the LS 200-5 system was designed and fabricated for testing in wind tunnels. Orbiter and launch configurations were tested over a speed range of Mach 0.6 to 2.0, whereas only the orbiter was tested over a speed range of Mach 2.3 to 4.6. Six-component force and moment data, base pressures, and schlieren photos were obtained at various angles-of-attack and sideslip. A 0.03-scale model of the orbiter was also designed, fabricated, and tested in a wind tunnel. Six-component force and moment data, base pressure, and a limited amount of tuft flow visualization data were obtained on a variety of configuration combinations. Author

N73-32771*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SHUTTLE ORBITAL APPLICATIONS AND REQUIREMENTS, SUPPLEMENTARY TASKS (SOAR-IIS) Final Report
Sep. 1973 365 p refs Sponsored in Part by TRW, Inc.
(Contract NAS8-28583)
(NASA-CR-124431; MDC-G4785) Avail: NTIS HC $20.25 CSCL 22A

Representative shuttle mission applications were studied. The interfaces analyses, and specific payloads are reported for the following types of missions: shuttle delivered automated spacecraft, shuttle/tug delivered spacecraft, man-tended automated spacecraft, and sortie missions. F.O.S.

N73-32772*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF ALTERNATE SPACE SHUTTLE CONCEPTS. VOLUME 2. PART 1: CONCEPT ANALYSIS AND DEFINITION
4 Jun. 1971 671 p
(Contract NAS8-26362)
(NASA-CR-124417; LMSC-A989142-Vol-2-Pt-1; ACS-124-Vol-2-Pt-1) Avail: NTIS HC $35.75 CSCL 22B

Three different space shuttle systems have been defined and analyzed. The first is a stage-and-one-half system optimized to meet program requirements. The second is a two-stage, fully reusable system also designed to meet program requirements. The third is a convertible system which operates initially as a stage-and-one-half system and is subsequently converted to a two-stage, fully reusable system by reconfiguration of the orbiter vehicle and development of a booster vehicle. The design and performance of this third system must necessarily be compromised somewhat to facilitate the conversion. For each system, the applicable requirements, ground rules, and assumptions are defined. The characteristics of each system are listed and a detailed description and analysis of the system are presented. Finally, a cost analysis for the system is given. Author

N73-32773*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF ALTERNATE SPACE SHUTTLE CONCEPTS. VOLUME 2, PART 2: CONCEPT ANALYSIS AND DEFINITION Final Report
4 Jun. 1971 681 p refs
(Contract NAS8-26362)
(NASA-CR-124422; LMSC-A989142-Vol-2-Pt-2; ACS-124B-Vol-2-Pt-2) Avail: NTIS HC $36.25 CSCL 22B
For abstract, see N73-32772.

N73-32774*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
STUDY OF ALTERNATE SPACE SHUTTLE CONCEPTS Final Report
28 Jun. 1971 441 p refs
(Contract NAS8-26362)
(NASA-CR-124421; LMSC-A990949; ACS-136) Avail: NTIS HC $24.25 CSCL 22B

A study of alternate space shuttle concepts was conducted to examine the stage-and-one-half concept and its potential for later conversion and use in the two stage reusable shuttle system. A study of external hydrogen tank concepts was conducted to determine the issues involved in the design and production of a low-cost expendable tank system. The major objectives of the study were to determine: (1) realistic drop tank program cost estimates, (2) estimated drop tank program cost for selected specific designs, and (3) change in program cost due to variations in design and manufacturing concepts and changes in program assumptions. Author

N73-32775*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
STUDY OF ALTERNATE SPACE SHUTTLE CONCEPTS, APPENDIX Final Report
28 Jun. 1971 437 p refs
(Contract NAS8-26362)
(NASA-CR-124418; LMSC-A990949-App; ACS-136-App) Avail: NTIS HC $24.00 CSCL 22B
For abstract, see N73-32774

N73-32776*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SKYLAB RESCUE SPACE VEHICLE OAT NO. 1 PLUGS IN TEST
S. J. Jevitt 15 Jun. 1973 46 p
(NASA-TM-X-69520; KSC-TCP-SV-41400R) Avail: NTIS HC $4.50 CSCL 22D

A test is described which demonstrates the compatibility of the Skylab Rescue Space Vehicle systems, the ground support equipment, and off-site support facilities by proceeding through a simulated launch countdown, liftoff, and flight. The functions of propellant loading, umbilical ejection, holddown arm release, service arm retraction, liftoff, and inflight separation are simulated. An external power source supplies transfer power to internal, and instrument unit commands are simulated by the digital command system. The test outline is presented along with a list of references, intercommunications information, radio frequency matrix, and interface control chart. Author

N73-32777*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SKYLAB RESCUE SPACE VEHICLE FLIGHT READINESS TEST
S. J. Jevitt 15 Jun. 1973 89 p refs
(NASA-TM-X-69519; KSC-TCP-SV-41407R) Avail: NTIS HC $6.50 CSCL 22D

A Skylab Rescue Space Vehicle flight readiness test is described which ensures that space vehicle systems are in a state of flight readiness and are compatible with associated ground support equipment. The functions of propellant loading, umbilical ejection, ignition, holddown arm release, liftoff, and service arm and tail service mast retraction are simulated. The test outline is presented along with a list of references, intercommunications information, operations interface control chart, and flight test. Author

N73-32778*# Kanner (Leo) Associates, Redwood City, Calif.
THE INVESTIGATOR ON-BOARD AN ORBITING SPACE STATION
Ye. Khrunov Washington NASA Oct. 1973 14 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 6, Jun. 1973 p 40-43
(Contract NASw-2481)
(NASA-TT-F-15152) Avail: NTIS HC $3.00 CSCL 22B

The significance of the scientific investigator in space flights is discussed. Noting that early space flights required the services primarily of pilots, the observation is made that there is an increasing tendency to send scientific specialists into space, and that this tendency is being increased still further by the use of orbiting space stations, primarily designed for scientific research rather than development of the flight equipment itself. Author

N73-32779*# Scientific Translation Service, Santa Barbara, Calif.
THE GERMAN AERONOMY SATELLITE AEROS
U. Picker, E. Bachor, P. Soppa, and W. Trogus Washington NASA Sep. 1973 34 p refs Transl. into ENGLISH from Raumfahrtforschung (West Germany), no. 2, 1973 p 49-57
(Contract NASw-2483)
(NASA-TT-F-15104) Avail: NTIS HC $3.75 CSCL 22B

The mission and the scientific payload of the German research satellite AEROS are summarized, along with the basic requirements for the technical concept and the subsystems of the

spacecraft. A brief description of the most important subsystems is given. Author

N73-32780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY GUIDED ROCKET FEASIBILITY STUDY
Mark B. Nolan and John J. Celmer Sep. 1973 13 p Submitted for publication
(NASA-TM-X-70474; X-742-73-288) Avail: NTIS HC $3.00 CSCL 16B

The feasibility of actively guiding sounding rockets to reduce impact dispersion has been investigated. The theoretical probability of range safety thrust termination for several high performance rockets was combined with the cost of acquiring the extended range at White Sands Missile Range (WSMR) to establish a guidance system price ceiling of $20K per flight. Guiding the Black Brant VC (BBVC) for the first five seconds of flight results in sufficient dispersion reduction to impact within the standard range boundaries at WSMR. The guidance system thrust level required to statically control the vehicle to a nominal-wind weighted trajectory for five seconds is between 150-200 pounds. A six-degree-of-freedom trajectory program with guidance simulation capability has been developed and the equations are presented. Author

N73-32781# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDY OF SHUTTLE-COMPATIBLE ADVANCED TECHNOLOGY LABORATORY (ATL)
Frederick O. Allamby Washington Sep. 1973 198 p refs
(NASA-TM-X-2813; L-9049) Avail: NTIS HC $5.25 CSCL 22B

A shuttle-compatible Advanced Technology Laboratory (ATL) that is particularly suited to technical expertise and research needs of the Langley Research Center is defined. The ATL concept combines Sortie Laboratory/pallet payload carrier systems, an integrated payload system of Langley experiments and experiments support equipment, and the shuttle sortie mission capability to provide Langley researchers with routine access to space. This effort provides an approach for accomplishing multidiscipline advanced technology experiments which can be evaluated by NASA management relative to its utilization by other NASA organizations, government agencies, universities, and industry. Author

N73-32782*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
EFFECT OF GEOMETRY ON THE NOSE-REGION FLOW-FIELD OF SHUTTLE ENTRY-CONFIGURATIONS
John J. Bertin and H. Tom Faria Aug. 1973 43 p refs
(Contract NAS9-10976)
(NASA-CR-134057; Rept-73002) Avail: NTIS HC $4.25 CSCL 22B

In order to determine the convective heat-transfer distribution for the nose region of the space shuttle entry configurations, a three-dimensional flow-field is described which may include extensive regions of separated flow. Because of the complexity of the flow field for the nose region, experimental data are needed to define the relation between the nose geometry and the resultant flow field. According to theoretical solutions of the three-dimensional boundary layer, the boundary layer separates from the leeward generator of a blunted cone at an alpha equal to the cone half-angle. Separation results from the transverse pressure gradient, i.e., the velocity derivative due to crossflow. The boundary layer limiting streamlines converge toward the singular point of separation. The separated region is bounded by an ordinary line of separation. Author

N73-32783*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC INVESTIGATIONS ON A 0.004 SCALE MODEL MCR 0074 BASELINE SPACE SHUTTLE LAUNCH VEHICLE AT MACH NUMBERS BETWEEN 0.6 AND 4.96
Paul Ramsey and M. K. Robertson Aug. 1973 400 p refs
(Contract NAS9-13247)
(NASA-CR-128778; DMS-DR-2026) Avail: NTIS HC $22.00 CSCL 22B

A test of a 0.004-scale MCR 0074 Baseline Launch Configuration Space Shuttle model was conducted in the NASA-MSFC 14 x 14-inch Trisonic Wind Tunnel (MSFC TWT 566). The objective of the test was to determine the effects of model parametric variations on aerodynamic static stability characteristics over a Mach number range from 0.6 to 4.96. Angles-of-attack from minus 10 deg to plus 10 deg at 0 deg sideslip and angles-of-sideslip from minus 10 deg to plus 10 deg at minus 5 deg, 0 deg, and plus 5 deg angle-of-attack were investigated. The basic configuration investigated was the integrated vehicle consisting of the orbiter, and external tank, and two solid rocket boosters. It was designated 03T9S3. Author

N73-32784*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALL SKY POINTING ATTITUDE CONTROL SYSTEM Patent Application
Kenneth R. Lorell and James P. Murphy, inventors (to NASA) Filed 4 Oct. 1973 35 p
(NASA-Case-ARC-10716-1; US-Patent-Appl-SN-403695) Avail: NTIS HC $3.75 CSCL 22B

In a strapped-down gyroscope space vehicle attitude control system, a method and apparatus are provided for gyro drift and input axis misalignment error compensation employing a sun and a star tracker and preselected vehicle calibration maneuvers. The outputs of two-axis strapped-down gyroscopes nominally aligned with the optical axis of the sun and star trackers, which are measured. The measured outputs provide gyro drift calibration, roll, pitch and yaw axis scale factors and values corresponding to the degree of nonorthogonality between the roll axis and the pitch and yaw gyro input axes and the nonorthogonality of the roll and pitch axes relative to the yaw axis. With the calibration data so obtained stored in a special purpose digital computer, the vehicle is then rolled and yawed through precomputed angles as modified by the calibration data to acquire a target without further recourse to external references. NASA

N73-32785# Volvo Flygmotor A.B., Trollhaettan (Sweden).
DEVELOPMENT OF AFT INLETS FOR A RAMJET POWERED MISSILE
Goesta Rosander 1972 47 p Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1973
Avail: NTIS HC $4.50

Described are a number of aerodynamic investigations performed to assess the possibilities to introduce a ramjet engine in a missile body of conventional lay-out. A schematic of a existing rocket propelled missile was selected as a reference configuration and a number of cruciform aft inlet systems were investigated. The Mach number range studied was 1.6 to 2.4 with bulk of the data taken around M = 2. The investigations cover the following areas: (1) measurement of missile drag properties; (2) check of missile aerodynamic performance; (3) selection of inlet type; (4) performance calibration of aft inlets; (5) effect of missile forebody geometry on inlet performance; and (6) development of engine control system reference pressure probes. It was concluded that introduction of the selected aft inlet system causes only small changes in missile drag and other aerodynamic properties. Used with a constant geometry ramjet engine the inlet and reference pressure probe combination provides 70% excess thrust at zero angle of attack and allows sustained flight at 5 to 6 deg angle of attack with the selected missile configuration. Author

N73-32786# Arbeitsgemeinschaft fuer Weltraumforschung, Munich (West Germany).
COMPATIBILITY STUDY OF AN ASTRONOMICAL SATELLITE A-6. PART 1: SCIENTIFIC OBJECTIVES AND EXPERIMENTS
Friedrich-Karl Schroeder, comp., Joachim Truemper (Tuebingen Univ., West Ger.), Volker Schoenfelder (Tuebingen Univ., West Ger.), Hans Elsaesser (Max-Planck-Inst. fuer Astronomie), Dietric h. Lemke (Max-Planck-Inst. fuer Astroonomie), Michael Grewing (Bonn Univ.), and Carsten Wulf-Mathies (Bonn Univ.) Bonn Bundesmin. fuer Bildung und Wiss. Aug. 1972 125 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-25) Avail: NTIS HC $8.25; ZLDI, Munich 26,25 DM

Three experiments for a first German Astronomical Satellite

are proposed: an X-ray experiment with high time resolution for studies of the extrasolar cosmic X-radiation; and two experiments in the IR- and UV-region, one of which is directed more to observations of the IR-brightness of the cosmic background radiation, the other to a survey of stars by means of an UV-spectroscopy with high resolution. The particular advantage consists in the long periods for single observations, which can be provided by a three-axis-stabilization. a description of the scientific objectives, concepts, and technical aspects of the experiments is given. Author (ESRO)

N73-32787# Arbeitsgemeinschaft fuer Weltraumforschung, Munich (West Germany).
COMPATIBILITY STUDY OF AN ASTRONOMICAL SATELLITE A-6. PART 2: TECHNICAL STUDY OF SPACECRAFT AND SUBSYSTEMS
Helmuth Hauck, Comp., Reinhold Bernsdorf, Frank Dolainsky, Wolfgang Duffek, Lothar Schmieder, Gerhard Miosga, and Ernst Schmidt Bonn Bundesmin. fuer Bildung und Wiss. Aug. 1972 225 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-26) Avail: NTIS HC $13.25; ZLDI, Munich 47,25 DM

The orbit, launch vehicle, and ground stations to accommodate the mission of the German astronomical satellite are discribed. For two combinations of two experiments, a satellite configuration was developed together with the relevant subsystems, which fulfill the mission requirements. A total weight of about 150 kg, which could be launched by a Scout D into a sun synchronous twilight orbit (apogee 580 km, eccentricity 0,006) is envisaged. The solar generator is mounted on deployable panels; the bitrate transmitted is max. 50 kbit/sec. A technical program plan for the feasibility study is given. Author (ESRO)

N73-32788# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
TITAN 3C GUIDANCE WITH THE CAROUSEL VB (VEHICLE BORNE) INERTIAL GUIDANCE SYSTEM Technical Report, Jul. 1971 - Dec. 1972
T. E. Darnaud and J. B. Shaul 29 Nov. 1972 61 p refs
(Contract F04701-72-C-0073)
(AD-764729; TR-0073(3413-02)-1; SAMSO-TR-73-220) Avail: NTIS CSCL 22/4

The Titan 3C Standard Space Launch Vehicle, starting with Vehicle 26, will use the Carousel VB Inertial Guidance System for navigation, guidance and digital flight controls. This guidance system consists of a Carousel VB Inertial Measurement Unit (IMU) and a MAGIC 352 Missile Guidance Computer (MGC). The C-VB IMU is a modification of the C-IVB inertial navigator currently in airline service as a primary navigation system. A unique feature of the Carousel IMU is that two of the three gyro/accelerometer sets are revolved at 1 rpm with respect to the stable platform. The effect is to partially cancel certain instrument errors associated with the revolving instruments. Conversion of this instrument from commercial airline navigation service to guidance and control of the rocket boost vehicle presented a guidance software design task that is the subject of the report. Author (GRA)

N73-32789# Aerojet Liquid Rocket Co., Sacramento, Calif.
ENGINEERING SUPPORT SERVICES Final Report, 12 Feb. 1972 - 13 May 1973
Richard W. Johnson, Ronald P. Arnold, Ed Highfield, John A. Mattice, and Terry L. Pearson 17 Jul. 1973 14 p
(Contract F19628-72-C-0229; AF Proj. 7659)
(AD-765231; ALRC-2823-FR-1; AFCRL-TR-73-0374) Avail: NTIS CSCL 19/7

The report contains a summary of the work performed by the Aerojet Liquid Rocket Company (ALRC) under Contract F19628-72-C-0229 from the Electronic Systems Division, AFSC. The work consisted of field support for launches of sounding rocket vehicles from Eglin Air Force Base, White Sands Missile Range, Western Test Range, and Churchill Research Range in Canada. The work also included engineering services as follows: payload re-entry analysis for flight A04.104, alignment of astrobee-D tail assemblies, recovery system modification, and engineering support of flight A03.911-1. Author (GRA)

N73-32790# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A STATISTICAL DECISION APPROACH TO MISSILE PAYLOAD DISCRIMINATION
N. J. Rikelis 18 Jul. 1973 22 p refs
(Contract F19628-73-C-0002; AF Proj. 627A)
(AD-764723; TN-1973-33; ESD-TR-73-229) Avail: NTIS CSCL 15/3

The report considers the statistical decision theory aspects of the problem of classifying each member of a fixed missile payload on the basis of observations of selected features. It is assumed that the payload contains two classes of objects, that the number of objects in each (payload mix) is known, and that the probability distribution of the feature observations for each class of objects is known. A simple Bayes classification test is first considered but makes no use of the payload mix information. This deficiency led to formulation of the improved test presented in this note which takes the mix information fully into account. The results of the two tests are then compared via simulation to discover the improvement gained by using the new test.
Author (GRA)

N73-32791# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
MISSILE SUPPORT VEHICLES Final Report
21 Mar. 1973 13 p refs
(AD-764772; TOP-2-2-040) Avail: NTIS CSCL 16/1

The report provides guidance for evaluation of missile support vehicle physical and operational characteristics. It identifies supporting tests, facilities, and equipment required. It discusses preparation for test requirements. The report provides procedures for initial inspection, servicing, vehicle characteristics, safety, endurance, durability, and reliability. It is applicable to wheeled and tracked vehicles such as self-propelled launched, loader transporter, launched trailer, and missile support truck. (Modified author abstract) GRA

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-32792 Florida Univ., Gainesville.
WAVE PROPAGATION IN FILAMENTARY COMPOSITE MATERIALS Ph.D.Thesis
Ernest Robert Jones 1972 132 p
Avail: Univ. Microfilms Order No. 73-15581

The behavior of impact-generated elastic stress waves propagating in rods of a unidirectional composite material was determined experimentally and compared to analytical predictions using a Fourier transform technique and a linear viscoelastic constitutive relation. Basic information regarding the variation of damping and phase velocity with frequency was measured using a beam vibration experiment for input to the computer codes. Additional measurements of the phase velocity in the ultrasonic region were made. Certain static moduli of the composite specimens were also measured. Steel-wire-reinforced epoxy was selected for the composite material. Two wire sizes and three volume fractions were used to investigate the effects of these parameters. Two rods of each material were fabricated, one with the filaments parallel to the rod axis, (0) deg, and one with the filaments perpendicular to the rod axis, (90) deg. Additional specimens with an additional smaller wire size were fabricated for the ultrasonic experiments. The results indicate that the wave speeds in the 0 deg and 90 deg composite rods can be accurately predicted from a knowledge of the constituent properties.
Dissert. Abstr.

N73-32793 Purdue Univ., Lafayette, Ind.
NONLINEAR DYNAMICS OF THIN ELASTIC SHELLS Ph.D. Thesis
Hatem R. Radwan 1972 192 p
Avail: Univ. Microfilms Order No. 73-15854

An effort to improve upon existing nonlinear analyses for

thin elastic shells by extending the modal expansion method of linear vibration analysis to its nonlinear analog is presented. General nonlinear modal equations are derived for thin shells of arbitrary geometry. As many modes as desired may be incorporated in the modal expansion, and the coefficients of the modal equations are obtained in the form of integral expressions over the surface of the shell. The nonlinear modal equations allow for the calculation of the nonlinear response of shells under any static or dynamic loading. The equations also make complete post-buckling investigations for thin shells of arbitrary geometry feasible.
Dissert. Abstr.

N73-32794 Case Western Reserve Univ., Cleveland, Ohio.
THE OPTIMUM STRUCTURAL DESIGN OF A DISCRETELY RING-STIFFENED CYLINDRICAL SHELL Ph.D. Thesis
Victor L. Genberg 1973 152 p
Avail: Univ. Microfilms Order No. 73-16128

The optimum design of a discretely ring-stiffened orthotropic cylindrical shell is treated. The analysis allows for a general structure with varying bay and ring properties subjected to multiple axial and pressure load conditions. The discrete rings are arbitrary in cross-section including the effects of shear deformation, eccentricity, warping, torsion, prestress, and out-of-plane bending. Design variables are selected according to the particular problem. The objective function is minimum weight. Failure modes include local buckling and yielding of each element, as well as the combined modes of gross, bay, and panel buckling. Flow charts, example cases, and a computer listing are included.
Dissert. Abstr.

N73-32795 California Univ., Los Angeles.
MODAL ANALYSIS FOR IMPACT OF LAYERED PLATES Ph.D. Thesis
James Toshio Kubo 1973 148 p
Avail. Univ. Microfilms Order No. 73-16686

The response of a laminated elastic plate to planar impact loads is discussed. Each layer is assumed to be of uniform thickness, with homogeneous orthotropic layers. The plate is approximately represented in the thickness direction by an assemblage of finite elements or laminas, while the component wavelength in the plate's longitudinal direction is specified. The vibratory modes of this system are extracted and used to develop the solution for the transient response. A homogeneous isotropic plate is analyzed for longitudinal wavelengths, long, intermediate, and short in comparison to the plate thickness. These wavelengths are representative of the range of wavelengths required to develop a transient analysis for a laminated plate. The impact forces are considered to be either surface tractions or body forces localized near a surface, and which vary either triangularly or as a half-sine in time. Dissert. Abstr.

N73-32796# Aeronautical Research Labs., Melbourne (Australia).
SOME PHENOMENOLOGICAL ASPECTS OF SCATTER IN FATIGUE
J. Y. Mann Nov. 1972 40 p refs
(ARL/SM-Rept-342) Avail: NTIS HC $4.00

Consideration is given to some of the phenomenogical aspects of variability in fatigue life and to the influence of material, loading, and test conditions, in particular the influence of cycle frequency, on scatter in endurance. It is concluded that relatively low scatter is associated with multiple crack initiation and that multiple crack initiation is more likely to occur with the establishment of conditions which cause or are conducive to local yielding of the material at critical sections. Tables of data are presented to show the properties of the materials used for the tests. Author

N73-32797*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RAPID ITERATIVE REANALYSIS FOR AUTOMATED DESIGN
Kumar G. Bhatia Washington Oct. 1973 51 p refs
(NASA-TN-D-7357; L-9070) Avail: NTIS HC $3.50 CSCL 20K

A method for iterative reanalysis in automated structural design is presented for a finite-element analysis using the direct stiffness approach. A basic feature of the method is that the generalized stiffness and inertia matrices are expressed as functions of structural design parameters, and these generalized matrices are expanded in Taylor series about the initial design. Only the linear terms are retained in the expansions. The method is approximate because it uses static condensation, modal reduction, and the linear Taylor series expansions. The exact linear representation of the expansions of the generalized matrices is also described and a basis for the present method is established. Results of applications of the present method to the recalculation of the natural frequencies of two simple platelike structural models are presented and compared with results obtained by using a commonly applied analysis procedure used as a reference. In general, the results are in good agreement. A comparison of the computer times required for the use of the present method and the reference method indicated that the present method required substantially less time for reanalysis. Although the results presented are for relatively small-order problems, the present method will become more efficient relative to the reference method as the problem size increases. An extension of the present method to static reanalysis is described, ana a basis for unifying the static and dynamic reanalysis procedures is presented.
Author

N73-32798*# Cincinnati Univ., Ohio.
OPTIMIZATION OF A CORRUGATED STIFFENED COMPOSITE PANEL UNDER UNIAXIAL COMPRESSION Final Technical Report, 1 Aug. 1972 - 31 Jul. 1973
B. L. Agarwal and L. H. Sobel 25 Jul. 1973 72 p refs
(Grant NGR-36-004-065)
(NASA-CR-132314) Avail: NTIS HC $5.75 CSCL 20K

An approach of structural optimization has been used to optimize the weight of a simply supported, corrugated hat stiffened composite panel under uniaxial compression. The approach consists of the employment of nonlinear mathematical programming techniques to reach an optimum solution. Some simplifying assumptions are made in the stress analysis to obtain faster convergence to an optimum solution. With these simplifying assumptions the number of unknown design parameters is reduced to twelve. Author

N73-32799*# Boeing Aerospace Co., Seattle, Wash.
CRITERIA FOR STRUCTURAL TEST Final Report
11 Aug. 1973 166 p refs
(Contract NAS8-29070)
(NASA-CR-124404) Avail: NTIS HC $10.50 CSCL 20K

The results of a study to define criteria and techniques of design, analysis and test which permit the use of a single major structural test article for performing dynamic, fatigue, and static testing are presented. The criteria developed is applicable to both space vehicles and aircraft structures operating in the subsonic or supersonic regime. The feasibility of such an approach was demonstrated by defining test interactions, compatibilities and incompatibilities between the three different types of tests. The results of the study indicate that the single test article concept is feasible with a testing sequence of dynamic test followed by a fatigue and static test. Author

N73-32800*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
A STUDY OF CRACK CLOSURE IN FATIGUE Final Report
T. T. Shih and R. P. Wei Washington NASA Oct. 1973 86 p refs
(Grant NGL-39-007-040)
(NASA-CR-2319; IFSM-72-25) Avail: NTIS HC $3.75 CSCL 20K

Crack closure phenomenon in fatigue was studied by using a Ti-6Al-4V titanium alloy. The occurrence of crack closure was directly measured by an electrical-potential method, and indirectly by load-strain measurement. The experimental results showed that the onset of crack closure depends on both the stress ratio, and the maximum stress intensity factor. No crack closure was observed for stress ratio, greater than 0.3 in this alloy. A two-dimensional elastic model was used to explain the behavior of the recorded load-strain curves. Closure force was estimated by using this model. Yield level stress was found near the crack tip. Based on this estimated closure force, the crack opening displacement was calculated. This result showed that onset of crack closure detected by electrical-potential measurement and

crack-opening-displacement measurement is the same. The implications of crack closure on fatigue crack are considered. The experimental results show that crack closure cannot fully account for the effect of stress ratio, on crack growth, and that it cannot be regarded as the sole cause for delay. Author

N73-32801*# Grumman Aerospace Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF STIFFENED SHELLS OF REVOLUTION. VOLUME 1: THEORY MANUAL FOR STARS-2S, 2B, 2V DIGITAL COMPUTER PROGRAMS
V. Svalbonas Washington NASA Sep. 1973 209 p refs 7 Vol.
(Contract NAS8-27468)
(NASA-CR-2273-Vol-1; M381-Vol-1) Avail: NTIS HC $5.50 CSCL 20K

The theoretical analysis background for the STARS-2 (shell theory automated for rotational structures) program is presented. The theory involved in the axisymmetric nonlinear and unsymmetric linear static analyses, and the stability and vibrations (including critical rotation speed) analyses involving axisymmetric prestress are discussed. The theory for nonlinear static, stability, and vibrations analyses, involving shells with unsymmetric loadings are included. Author

N73-32802*# Grumman Aerospace Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF STIFFENED SHELLS OF REVOLUTION. VOLUME 2: USERS' MANUAL FOR STAR-02S - SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES - 2 (STATICS), DIGITAL COMPUTER PROGRAM
V. Svalbonas Washington NASA Sep. 1973 311 p refs 7 Vol.
(Contract NAS8-27468)
(NASA-CR-2273-Vol-2; M381-Vol-2) Avail: NTIS HC $7.00 CSCL 20K

A procedure for the structural analysis of stiffened shells of revolution is presented. A digital computer program based on the Love-Reissner first order shell theory was developed. The computer program can analyze orthotropic thin shells of revolution, subjected to unsymmetric distributed loading or concentrated line loads, as well as thermal strains. The geometrical shapes of the shells which may be analyzed are described. The shell wall cross section can be a sheet, sandwich, or reinforced sheet or sandwich. General stiffness input options are also available. Author

N73-32803*# Grumman Aerospace Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF STIFFENED SHELLS OF REVOLUTION. VOLUME 3: USERS' MANUAL FOR STARS-2B, 2V, SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES, 2 (BUCKLING, VIBRATIONS), DIGITAL COMPUTER PROGRAMS
V. Svalbonas Washington NASA Sep. 1973 459 p
(Contract NAS8-27468)
(NASA-CR-2273-Vol-3; M381-Vol-3) Avail: NTIS HC $9.00 CSCL 20K

The User's Manual for the shell theory automated for rotational structures (STARS) 2B and 2V (buckling, vibrations) is presented. Several features of the program are: (1) arbitrary branching of the shell meridians, (2) arbitrary boundary conditions, (3) minimum input requirements to describe a complex, practical shell of revolution structure, and (4) accurate analysis capability using a minimum number of degrees of freedom. Author

N73-32804*# Grumman Aerospace Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF STIFFENED SHELLS OF REVOLUTION. VOLUME 4: ENGINEER'S PROGRAM MANUAL FOR STARS-2S SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES - 2 (STATICS) DIGITAL COMPUTER PROGRAM
V. Svalbonas and P. Ogilvie Washington NASA Sep. 1973 176 p ref 7 Vol.
(Contract NAS8-27468)
(NASA-CR-2273-Vol-4; M381-Vol-4) Avail: NTIS HC $5.25 CSCL 20K

The engineering programming information for the digital computer program for analyzing shell structures is presented. The program is designed to permit small changes such as altering the geometry or a table size to fit the specific requirements. Each major subroutine is discussed and the following subjects are included: (1) subroutine description, (2) pertinent engineering symbols and the FORTRAN coded counterparts, (3) subroutine flow chart, and (4) subroutine FORTRAN listing. Author

N73-32805*# Grumman Aerospace Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF STIFFENED SHELLS OF REVOLUTION. VOLUME 5: ENGINEER'S PROGRAM MANUAL FOR STARS-2B-SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES-2 (BUCKLING), DIGITAL COMPUTER PROGRAM
V. Svalbonas and P. Ogilvie Washington NASA Sep. 1973 185 p ref 7 Vol.
(Contract NAS8-27468)
(NASA-CR-2273-Vol-5; M381-Vol-5) Avail: NTIS HC $5.25 CSCL 20K
For abstract, see N73-32804

N73-32806*# Grumman Aerospace Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF STIFFENED SHELLS OF REVOLUTION. VOLUME 6: ENGINEER'S PROGRAM MANUAL FOR STARS-2V-SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES - 2 (VIBRATION), DIGITAL COMPUTER PROGRAM
V. Svalbonas and P. Ogilvie Washington NASA Sep. 1973 192 p ref 7 Vol.
(Contract NAS8-27468)
(NASA-CR-2273-Vol-6; M381-Vol-6) Avail: NTIS HC $5.25 CSCL 20K
For Abstract, see N73-32804

N73-32807*# Grumman Aerospace Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF STIFFENED SHELLS OF REVOLUTION. VOLUME 7: SATELLITE PROGRAMS FOR THE STARS SYSTEM
V. Svalbonas and P. Ogilvie Washington NASA Sep. 1973 185 p refs 7 Vol.
(Contract NAS8-27468)
(NASA-CR-2273-Vol-7; M381-Vol-7) Avail: NTIS HC $5.25 CSCL 20K

The user and programming information necessary for the application of the SATELLITE programs for the STARS system are presented. The individual program functions are: (1) data debugging for the STARS-2S program, (2) Fourier series conversion program, (3) data debugging for the STARS-2B program, and (4) data debugging for the STARS-2V program. Author

N73-32808# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
SIMULTANEOUS STRUCTURE AND PARAMETER IDENTIFICATION OF LINEAR DYNAMICAL SYSTEMS
S. J. Merhav and E. Gabay Feb. 1973 35 p refs
(TAE-173) Avail: NTIS HC $3.75

All known methods for the identification of parameters, in linear systems, assume a priori exact knowledge of system order and structure. This restriction is a result of the conventional formulation of the differential equation which describes the model. By adopting an alternative formulation, a reciprocal model is introduced which may be of an arbitrary high order. Its implementation in the identification process results in making all the redundant parameters converge to zero. Thus, both system's structure, order and parameter vector are simultaneously identified. Consequently, the above restriction of a priori knowledge of system order and structure is removed. Some limitations due to noise and computing equipment are indicated. Simulated examples which demonstrate the power of the method are given. Author

N73-32809# Wisconsin Univ., Madison. Mathematics Research Center.
AN ACCURATE FOURTH ORDER EQUATION FOR CIRCULAR CYLINDRICAL SHELLS
Shun Cheng Jun. 1973 33 p refs
(Contract DA-ARO(D)-31-124-G462)
(AD-764560; MRC-TSR-1198) Avail: NTIS CSCL 20/11

The paper discusses a pair of complex conjugate fourth order partial differential equations which govern the deformation of circular cylindrical shells. GRA

N73-32810# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEPENDENCE OF DURABILITY ON THE TYPE OF LOADING AND ON FACTORS WHICH CHARACTERIZE THE TEST CONDITIONS
B. M. Vakhitov 7 May 1973 22 p refs Transl. into ENGLISH from Vop. Eks. Prochnosti i Nadezhnosti Aviats. Konstrukt. (Rigga), no. 191, 1971 p 58-76
(AD-764665; FTD-HT-23-257-73) Avail: NTIS CSCL 20/11

The report examines the use of laws governing the stress-rupture strength for structural materials under conditions of cyclic loading. The use of equations of the kinetic theory of solids enables one to determine the dependence of number of cycles before destruction on the type of the load cycle, stress in the cycle, and test temperature. (Modified author abstract) GRA

N73-32811# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY. 6: A FINITE ELEMENT METHOD FOR PLASTICITY PROBLEMS
Philip G. Hodge, Jr., Vijay K. Garg, and Subhash C. Anand May 1973 23 p refs
(Contract N00014-67-A-0113-0025; NR Proj. 064-429)
(AD-764574; AEM-H1-6) Avail: NTIS CSCL 20/11

A method is presented for finding complete solutions (stresses and displacements) for plasticity problems. The problem is first approximated by a finite-element model and a rate formulation is used. An exact solution for the stress rates is obtained by solving the quadratic programming problem which expresses the static minimum principle. Using some but not all of the information from this solution, the velocities are easily obtained from the kinematic minimum principle. The method is applied to a model for a wheel rolling on a rigid track. Maximum elastic loads, collapse loads, and shakedown loads are found for both gravity and hub loading. For loads between shakedown and collapse it is found that failure is incremental for gravity loading but cyclic for hub loading. Author (GRA)

N73-32812# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY. 7: ELASTIC-PLASTIC ANALYSIS OF A WHEEL ROLLING ON A RIGID TRACK
Vijay K. Garg, Subhash C. Anand, and Philip G. Hodge, Jr. May 1973 34 p refs
(Contract N00014-67-A-0113-0025; NR Proj. 064-429)
(AD-764575; AEM-H1-7) Avail: NTIS CSCL 20/11

A consistent finite element model for a circular wheel is developed based on triangular and quasi-triangular domains and a piecewise linear displacement field. The minimum stress-rate principle of plasticity is used to obtain solutions of two-dimensional continuum problems with internal unloading. A piecewise approximation of the Tresca yield condition is used. Elastic-plastic solutions of a wheel rolling on a rigid track under its own weight and a hub load are obtained for the first few revolutions until a steady state condition is reached. Shakedown conditions for the wheel are demonstrated. Author (GRA)

N73-32813# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY. 8: POST-YIELD BEHAVIOR OF A BEAM WITH PARTIAL END FIXITY
Philip G. Hodge, Jr. Jul. 1973 12 p refs
(Contract N00014-67-A-0113-0025; NR Proj. 064-429)
(AD-764576; AEM-H1-8) Avail: NTIS CSCL 20/11

A simple supported beam can undergo a relative axial displacement proportional to the induced axial force. Complete formulas and curves are obtained for transverse displacements of the order of the beam thickness. Author (GRA)

N73-32814# Notre Dame Univ., Ind. Coll. of Engineering.
OPTIMAL DESIGN OF SUBMERGED ELASTIC CYLINDRICAL SHELLS
Elmer Joseph Kuhn, III and Nai-Chien Huang Jul. 1973 35 p refs
(Contract N00014-68-A-0152)
(AD-764578; UND-73-8) Avail: NTIS CSCL 20/11

The report deals with the problem of optimal design of submerged elastic cylindrical shells for maximum pressure. Approximate solution is obtained by the Rayleigh-Ritz method within the extent of presumed form of distribution function of shell thickness. Optimal configuration of the shell is found for a wide range the length-radius-ratio of the shell. Author (GRA)

N73-32815# Stanford Univ., Calif. Dept. of Applied Mechanics.
ELASTIC-PLASTIC THEORY AT FINITE STRAIN Interim Report
E. H. Lee and P. Germain Jun. 1973 27 p refs
(Contract N00014-67-A-0112-0060; NR Proj. 064-471)
(AD-764557; SUDAM-73-4; Rept-21) Avail: NTIS CSCL 20/11

It is shown that in order to solve certain technological problems, it is necessary to develop elastic-plastic theory for which both components of strain can be finite. This poses a challenging problem because of the need to include nonlinear discontinuous response to loading history, that is to determine nonlinear discontinuous functionals. Various approaches to this challenge are considered and contrasted. The possible advantages of direct extension of classical approaches is expressed. Questions of the validity and applicability of suggested theories are considered from the standpoints of invariance, convenience of representation for specific materials and for introduction into stress and strain analysis evaluations. Thermodynamic aspects are also discussed. Author (GRA)

N73-32816# Notre Dame Univ., Ind. Coll. of Engineering.
DYNAMIC ANALYSIS OF ELASTIC PLATES WITH CIRCULAR HOLES
R. F. Hegarty and T. Ariman Aug. 1973 52 p refs
(Contract N00014-68-A-0152)
(AD-765361; UND-73-9) Avail: NTIS CSCL 13/10

The problem of the free vibrations of a rectangular elastic plate, either clamped or simply supported, with a central circular hole has been investigated by a least-squares point-matching method. The results are given in the form of curves relating the natural frequency of the plate to the hole size for a variety of Poisson's ratios. The curves do not behave monotonically, and the hole size at which the frequency is a minimum is seen to be dependent not only on the boundary conditions but also on Poisson's ratio. A two-fold mechanism of strain relief and mass reduction is proposed to explain these results as well as the results of previous studies on the vibrations of plates with discontinuities. Author (GRA)

N73-32817# Utah Univ., Salt Lake City. Dept. of Civil Engineering.
A NOTE RELATIVE TO THE REST CONSTRAINT IN FINITE ELASTICITY
J. Edmund Fitzgerald Jul. 1973 26 p refs
(Grant AF-AFOSR-2322-72)
(AD-764667; UTEC-CE-73-135) Avail: NTIS CSCL 20/11

The equations of finite elasticity whether derived from a Cauchy constitutive assumption or a Green (elastic potential) assumption reduce to equivalent forms. The usually published forms do not automatically satisfy the rest state condition wherein the stress vanishes. The rest state constraint often associated with a strain energy function is shown herein to be nonapplicable. That is, use of the rest state constraint on the form of the strain energy function precludes Neo-Hookean behavior as well as severely restricting the form of a Mooney-Rivlin material. It is shown that the rest state condition leads to a form of the constitutive equation wherein no restrictions (other than certain smoothness and differentiability assumptions) are placed upon the form of the strain energy function. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-32818* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTROSTATICALLY CONTROLLED HEAT SHUTTER Patent
Lloyd J. Derr, inventor (to NASA) Issued 9 Oct. 1973 5 p Filed 28 Jun. 1972 Supersedes N72-28923 (10 - 19, p 2625) Sponsored by NASA
(NASA-Case-NPO-11942-1; US-Patent-3,763,928; US-Patent-Appl-SN-266866; US-Patent-Class-165-32; US-Patent-Class-165-96; US-Patent-Class-165-106; US-Patent-Class-244-1SS) Avail: US Patent Office CSCL 20M

A heat transfer assembly for conducting thermal energy is described. The assembly includes a hermetically sealed container enclosing a quantity of inert gas such as nitrogen. Two opposed walls of the container have high thermal conducting characteristics while the connecting walls have low thermal conducting characteristics. Electrodes are positioned adjacent to the high thermal conducing walls and biased relative to the conducting walls to a corona potential for creating an ionic gas wind which must contact the conducting walls to be neutralized. The contact of the gas molecules permits the maximum thermal energy transfer between the walls. Baffles can be positioned adjacent to the electrodes to regulate gas flow between the high thermal conducting surfaces. Official Gazette of the U.S. Patent Office

N73-32819 Illinois Univ., Urbana.
SUBCOOLED FORCED CONVECTION FILM BOILING IN A VERTICAL ANNULUS Ph.D. Thesis
William P. Barnes 1973 236 p
Avail: Univ. Microfilms Order No. 73-17497

Stabilized film boiling was attained with subcooled water flowing upwards in the cylindrical annulus of a 30-inch vertical test section, 0.75-inch I.D. and 1.50-inch O.D. A wide range of heat flux was obtained through the electrical resistance heating of a 125-mil tube of Hastelloy-C nickel alloy. Film boiling was, for the most part, local and heterogeneous. From five to ten thermocouples would usually indicate film boiling simultaneously, but along an axial line rather than in a circumferential one which would fully develop the heater tube. Boiling burnout heat flux increased with flow rate and with water outlet quality or subcooling. Forced convection film boiling heat transfer was analyzed using both laminar and turbulent boundary layer theory. Reasonable agreement was obtained for the vapor and liquid thicknesses using turbulent boundary layer theory. Computer solutions using experimental burnout heat flux and coolant velocity and thermodynamic properties produced reasonable eddy diffusivity values and turbulent liquid-vapor velocity profiles.
Dissert. Abstr.

N73-32820 State Univ. of New York, Stony Brook.
DENSITY DEPENDENCE OF THE HEAT CAPACITY ANOMALY IN LIQUID He-4 NEAR THE LAMBDA TRANSITION Ph.D. Thesis
Tun-Hsu McCoy 1973 98 p
Avail: Univ. Microfilms Order No. 73-15909

In order to provide more information on the thermodynamics of the lambda transition in liquid helium, a series of precision measurements were performed of the temperature variation of the constant volume heat capacity C sub v of liquid He4 near the lambda point in samples covering the complete density range between the saturated vapor and freezing pressures. A sealed bomb method was used. It was found that, for He2, our C sub v data have a temperature dependence that is close to logarithmic at all densities; while for He1 C sub v is close to logarithmic only at the lowest densites and obeys finite power laws at higher densities. Comparisons with the results of other workers are made.
Dissert. Abstr.

N73-32821# British Columbia Univ., Vancouver. Dept. of Chemical Engineering.
STUDIES ON AIR EMISSIONS FROM THE COMBUSTION OF WOOD WASTE
C. B. Prakash and F. E. Murray 1972 29 p refs
(WSCI-72-1) Avail: NTIS HC $3.50

Experiments, under controlled conditions, were conducted on the combustion of wood waste to establish the effects of process variables on the emission of air pollutants. Temperature in the combustion zone was found to be the most important parameter affecting the combustion process and associated air pollutants. The amounts of air pollutants were minimal at combustion zone temperatures greater than 1100 F. The hydrocarbons present in aerosol form in the exhaust gases were identified as abiatic acid and stearic acid. The gaseous hydrocarbon in the exhaust gases was mostly methane. The average combustion rate increased with increasing combustion zone temperature, with decreasing moisture content in the fuel, with increasing total air flow rate, and with decreasing secondary to primary air ratio. The particle size in the wood-waste and the type of the grate were also found as important variables for the combustion process.
Author

N73-32822*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF INLET-AIR HUMIDITY, TEMPERATURE, PRESSURE, AND REFERENCE MACH NUMBER ON THE FORMATION OF OXIDES OF NITROGEN IN A GAS TURBINE COMBUSTOR
Nicholas R. Marchionna, Larry A. Diehl, and Arthur M. Trout Washington Oct. 1973 34 p refs
(NASA-TN-D-7396; E-7465) Avail: NTIS HC $3.00 CSCL 21B

Tests were conducted to determine the effect of inlet air humidity on the formation of oxides of nitrogen (NOx) from a gas turbine combustor. Combustor inlet air temperature ranged from 506 K (450 F) to 838 K (1050 F). The tests were primarily run at a constant pressure of 6 atmospheres and reference Mach number of 0.065. The NOx emission index was found to decrease with increasing inlet air humidity at a constant exponential rate: NOx = NOx0e-19H (where H is the humidity and the subscript 0 denotes the value at zero humidity). the emission index increased exponentially with increasing normalized inlet air temperature to the 1.14 power. Additional tests made to determine the effect of pressure and reference Mach number on NOx showed that the NOx emission index varies directly with pressure to the 0.5 power and inversely with reference Mach number.
Author

N73-32823*# Hamilton Standard, Windsor Locks, Conn.
CONDENSATE REMOVAL DEVICE FOR HEAT EXCHANGE Patent Application
Raymond B. Trusch and Edward W. Connor, inventors (to NASA) Filed 31 Aug. 1973 21 p Sponsored by NASA
(Contract NAS9-10273)
(NASA-Case-MSC-14143-1; US-Patent-Appl-SN-393526) Avail: NTIS HC $3.25 CSCL 20M

The development of a device to be added to a condensing-type heat exchanger to remove condensed liquid from the heat exchanger is discussed. The construction details and method of operation are described. The main advantage of the system lies in providing a condensate removal device which does not require a liquid absorbing material and which can be used with heat exchangers which have a straight through gas flow to reduce or eliminate the spitting of condensate which would occur otherwise.
NASA

N73-32824*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Advance Propulsion Dept.
INVESTIGATION OF HIGH-PERFORMANCE INSULATION APPLICATION PROBLEMS Final Report
G. O. Fredrickson Aug. 1973 263 p refs
(Contract NAS8-21400)
(NASA-CR-124400; MDC-G4722) Avail: NTIS HC $15.25 CSCL 20M

The design, fabrication, and performance of a practical, flightworthy, multilayer insulation (MLI) system for a Modular Nuclear Vehicle (MNV) LH2 propellant tank is presented. An MLI system is now available. It may be applied to the MNV or any other space vehicle requiring MLI for thermal control. This design concept was adapted for an MLI installation that covered and was successfully flown on the Skylab forward dome.
Author

N73-32825*# California Univ., Berkeley. Div. of Aeronautical Sciences.

EXPERIMENTAL STUDY OF THE DYNAMICS OF A SPHERICAL FLAME
A. K. Oppenheim, M. M. Kamel, and C. Varvatsoulis [1973] 15 p refs
(Grant NGR-05-003-050; AF-AFOSR-0129-67; NSF GK-2156)
(NASA-CR-135672) Avail: NTIS HC $3.00 CSCL 21C

Preliminary results of an experimental study conducted to investigate the dynamic behavior of flames in explosive gases are presented. The medium was an equimolar acetylene-oxygen mixture maintained initially at a pressure of 110 torr. and room temperature in an experimental vessel 9 cm in internal diameter. Ignition was performed by means of a neodymium laser beam focused on a 0.3 mm diameter steel wire. Experimental observations were performed by the use of a stroboscopic laser-schlieren system yielding a set of photographic records of wave phenomena at a frequency of 200,000 per second. The records reveal the existence of a number of shocks which by a thorough analysis of the blast wave generated by the ignition process, are shown to be due entirely to the flame generated flow field. The capability of a flame to form blast waves in an expanding spherical geometry is thus established, providing an experimental demonstration of the significance the dynamic effects of combustion can achieve. Author

N73-32826*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FUSED SLURRY SILICIDE COATINGS FOR COLUMBIUM ALLOYS REENTRY HEAT SHIELDS. VOLUME 1: EVALUATION ANALYSIS Final Report
Barry Fitzgerald Aug. 1973 144 p refs 2 Vol.
(Contract NAS3-14307)
(NASA-CR-121216; MDC-E0784-Vol-1) Avail: NTIS HC $9.25 CSCL 20M

The R-512E (Si-20Cr-20Fe) fused slurry silicide coating process was optimized to coat full size (20in x 20in) single face rib and corrugation stiffened panels fabricated from FS-85 columbium alloy for 100 mission space shuttle heat shield applications. Structural life under simulated space shuttle lift-off stresses and reentry conditions demonstrated reuse capability well beyond 100 flights for R-512E coated FS-85 columbium heat shield panels. Demonstrated coating damage tolerance showed no immediate structural failure on exposure. The FS-85 columbium alloy was selected from five candidate alloys (Cb-752, C-129Y, WC-3015, B-66 and FS-85) based on the evaluation tests which have designed to determine: (1) change in material properties due to coating and reuse; (2) alloy tolerance to coating damage; (3) coating emittance characteristics under reuse conditions; and (4) new coating chemistries for improved coating life. Author

N73-32827*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FUSED SLURRY SILICIDE COATINGS FOR COLUMBIUM ALLOY REENTRY HEAT SHIELDS. VOLUME 2: EXPERIMENTAL AND COATING PROCESS DETAILS Final Report
Barry Fitzgerald Aug. 1973 202 p refs 2 Vol.
(Contract NAS3-14307)
(NASA-CR-134483; MDC-E0784-Vol-2) Avail: NTIS HC $12.25 CSCL 20M

The experimental and coating process details are presented. The process specifications which were developed for the formulation and application of the R-512E fused slurry silicide coating using either an acrylic or nitrocellulose base slurry system is also discussed. Author

N73-32828*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRUCTURAL HEAT PIPE Patent Application
Stanford Ollendorf, inventor (to NASA) Filed 14 Sep. 1973 14 p
(NASA-Case-GSC-11619-1; US-Patent-Appl-SN-397476) Avail: NTIS HC $3.00 CSCL 20M

A combined structural reinforcing element and heat transfer member is described for placement between a structural wall of a container or housing which is to be thermally protected and an outer insulation blanket disposed thereover and spaced apart therefrom. The element consists of a heat pipe, one side of which supports the outer insulation blanket, the opposite side of which is connected to the structural wall. Heat penetrating through the outer insulation blanket directly reaches the heat pipe and is drawn off, thereby reducing thermal gradients in the structural wall. The element, due to its attachment to the structural wall, further functions as a reinforcing member. NASA

N73-32829# Naval Postgraduate School, Monterey, Calif.
A COLOR SCHLIEREN STUDY OF AMMONIUM PERCHLORATE AND AMMONIUM PERCHLORATE-BINDER SANDWICH COMBUSTION M.S. Thesis
James LeRoy Murphy, III Mar. 1973 68 p refs
(AD-764489) Avail: NTIS CSCL 21/2

Single crystal and pressed polycrystalline ammonium perchlorate and ammonium perchlorate-binder (polybutadiene acrylic acid, hydroxyl terminated polybutadiene, polyurethane, and carboxyl terminated polybutadiene) sandwiches were burned in a nitrogen-purged combustion bomb at pressures above and below the lower pressure deflagration limit of ammonium perchlorate. High-speed color schlieren and regular motion pictures were taken of the combustion process in order to determine the effects of pressure binder type, binder thickness, and purity of ammonium perchlorate on the deflagration. Author (GRA)

N73-32830# Texas A&M Univ., College Station. Dept. of Physics.
SOLUTIONS OF THE EQUATION OF TRANSFER FOR A MEDIUM BOUNDED BY A PERFECT SPECULAR REFLECTOR IN TERMS OF THOSE FOR A PERFECT ABSORBER
George W. Kattawar 22 May 1973 9 p refs Submitted for publication
(Contract N00014-68-A-0308-0002; NR Proj. 083-036)
(AD-764619; A/M-Ref-73-11T; Rept-5) Avail: NTIS CSCL 04/1

In a recent paper Casti et al. showed that the solution to the equation of radiative transfer for a homogeneous plane parallel atmosphere bounded by a perfect specular reflector could be expressed in terms of the solutions for the same atmosphere bounded from below by a perfect absorber. They only considered the case where the atmosphere scattered radiation isotropically and hence there was no azimuthal dependence. A simple proof of this relation is given here. Furthermore, it is shown that it is valid in the more general case when anisotropic scattering is present. Author (GRA)

N73-32831# Stanford Univ., Calif.
RADIATIVE TRANSPORT IN ELECTRIC ARCS Final Report, 1 Feb. 1971 - 30 Nov. 1972
R. S. Devoto and D. Mukhertee Wright-Patterson AFB, Ohio ARL Jul. 1973 25 p refs
(Contract F33615-71-C-1289; AF Proj. 7073)
(AD-765207; ARL-73-0111) Avail: NTIS CSCL 20/13

Equations are developed which govern the behavior of a wall-stabilized electric arc in which heat transfer takes place via conduction and radiation emission and reabsorption within the heated gas. The differential approximation is used to describe the radiative transport. Several numerical schemes are described which were used in an attempt to integrate these equations; none were found to work for all values of the absorption coefficient. A discussion of the development of higher-order differential approximations is also included. Author (GRA)

N73-32832# Physical Dynamics, Inc., Detroit, Mich.
PLUME OBSERVABLES AND COUNTERMEASURES Semiannual Technical Report
Frederick P. Boynton 31 Jul. 1972 67 p refs
(Contract F19628-72-C-0006; ARPA Order 1856; AF Proj. 8692)
(AD-764908; PD-72-027; SATR-2; AFCRL-72-0632) Avail: NTIS CSCL 07/4

Further work on the radiative behavior of rocket exhaust plumes at high altitude is reported. Comparisons of calculated flow fields with wind-tunnel test data indicate that agreement is generally satisfactory if allowances are made for absolute calibrations of the data. Calculations of a plume emission according to some proposed mechanisms have been performed. It appears that production of OH by O atom attack on secondary H atoms in hydrocarbon fragments can result in substantial

chemiluminescent emission from H2O formed by subsequent reaction of the OH. Some semi-quantitative analogies between rocket exhaust flows and material releases in the upper atmosphere are discussed, and derivations directed toward comparing collision energy distributions at very high altitudes are presented.
Author (GRA)

N73-32833# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TEMPERATURE DEPENDENCE OF V-V AND V-R T ENERGY TRANSFER MEASUREMENTS IN MIXTURES CONTAINING HF, NOVEMBER 1971 - SEPTEMBER 1972
Jerry F. Bott and Norman Cohen 31 Aug. 1973 59 p refs
(Contract F04701-73-C-0074)
(AD-765183; TR-0074(4530)-4; SAMSO-TR-73-224) Avail: NTIS CSCL 07/4

A pulsed HF chemical laser has been used to excite HF molecules to their first vibrational level. The decay times of the infrared fluorescence from HF(v-1) have been used to determine the rate coefficients for energy transfer from HF to various collision partners including H2, D2, N2, O2, DF, HCl, CO2, NO, CO, and HBr. The experiments were performed at temperatures from 450 to 1000K for most of the molecules, as well as at 295K. The room-temperature probabilities of energy transfer from HF to the various molecules plotted versus energy mismatch fell along two distinct lines: one for homonuclear and one for heteronuclear molecules. The room-temperature relaxation rates of HF in the presence of the various molecules were measured. (Modified author abstract) GRA

N73-32834# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LASER IGNITION OF PYROTECHNIC COMPOSITIONS BEING TESTED AS DRAG-REDUCING FUMERS
J. Richard Ward, Richard K. Pahel, and Kevin J. White Jul. 1973 18 p refs
(DA Proj. 1J5-62604-A-600; DA Proj. 1W5-62603-A-005)
(AD-765415; BRL-MR-2308) Avail: NTIS CSCL 19A

A series of pyrotechnic compositions being considered as drag-reducing fumers was ignited with a 50 watt, continuous, CO2 laser. This provides us with a remote energy source capable of igniting pyrotechnic mixes in wind tunnel studies to assess their effectiveness as fumers, and opens the possibility of studying pyrotechnic ignition using a laser as has recently been done with solid propellants. Author (GRA)

N73-32835# National Materials Advisory Board, Washington, D.C.
TREATMENT AND DISPOSAL OF HIGH-ENERGY MATERIALS Final Report
Jun. 1973 107 p refs
(AD-764534; NMAB-305) Avail: NTIS CSCL 19/1

The report is intended to provide an overview of naval munitions treatment and disposal, and a delineation of some suggested general and specific avenues of research and development that will enhance future progress in the area. Environmental protection and safety to personnel, as well as the engineering involved in the treatment and disposal of high-energy materials of all the services (Army, Navy and Air Force), are of primary concern. In the past, much of the work in this field has been motivated largely by expedient technological considerations. Therefore, the principal aspects of environmental impact problems underlying the more important treatment and disposal problems are discussed, and the technology of potential processes for solving these problems is reviewed.
Author (GRA)

N73-32447 Joint Publications Research Service, Arlington, Va.
ONE OPTIMUM CASE OF A METHOD OF AXIAL THERMAL FLOW FOR DETERMINING THE COEFFICIENT OF THERMAL CONDUCTIVITY
V. S. Klimenko, O. A. Dobrovolskiy, and I. K. Senchenkov *In its* Technol. of Producing New Mater. (JPRS-59873) 23 Aug. 1973 p 21-24 refs Transl. into ENGLISH from the publ. "Tekhnologiya Polucheniya Novykha Materialov" Kiev, 1972 p 51 58 (For availability see N73-32441 23-18)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-32836*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL QUARTERLY TECHNICAL REVIEW, VOLUME 3, NO. 1, APRIL 1973
Apr. 1973 149 p refs
(Contract NAS7-100)
(NASA-CR-135529) Avail: NTIS HC $9.50 CSCL 05A

Technical data covering small rocket engine tests in space simulators, planetary exploration, radiation hardened solar cells, and solubility of molar volume liquids are presented. For individual titles, see N73-32837 through N73-32841.

N73-32837* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATION OF SMALL ROCKET ENGINES IN THE JPL HIGH-VACUUM MOLECULAR SPACE SIMULATOR (MOLSINK) **c28**
J. E. Chirivella *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 1-13 refs (For availability see N73-32836 23-34) CSCL 21H

The feasibility of operating small rocket engines in the Molsink facility was demonstrated. A 0.44-N (0.1-lbf) hydrazine engine and a 0.18-N (0.04-lbf) thruster using cold gas from a hydrazine plenum system were operated for both flight duty cycles and off-nominal conditions. The exhaust gases from these thrusters contain NH3, N2, and H2. The chamber was also calibrated for larger bipropellant engines using nitrogen tetroxide/monomethyl hydrazine (NTO/MMH). The exhaust products of these engines contain CO2, CO, H2, H2O, and H2. A mixture of cold gases simulating the engine exhaust was injected through a nozzle under conditions simulating thrust levels up to 26.7-N (6 lbf). Pulsing and continuous operations were investigated. The chamber background pressure traces were compared with the traces obtained for the same thrusters operated with pure nitrogen at approximately equivalent thrust. Satisfactory recuperation times were encountered in all the pulsing modes. Test times greater than 20s were obtained in steady state operation before the vacuum chamber back pressure climbed to prohibitive values.
Author

N73-32838* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SATURN SATELLITE ENCOUNTER OPPORTUNITIES FOR MARINER JUPITER-SATURN 1977 **c30**
R. A. Wallace *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 14-25 refs (For availability see N73-32836 23-34) CSCL 22A

The opportunities for close satellite encounters which meet the planetary constraints at Saturn that are imposed by science value return and environmental conditions are investigated. Since the satellites travel at various speeds in their orbits, Saturn arrival time is critical and was chosen as the design parameter. Arrival times are recommended which afford close satellite encounters and also meet important mission constraints. A design chart illustrates the satellite opportunities as a function of Saturn arrival date. Through the use of such a design chart, the Saturn encounter design process, which will take place according to recommendations by the selected science investigators over the next several years, will be considerably streamlined. Potential applications are given to illustrate the use of the Saturn satellite opportunity chart in encounter design. Author

N73-32839* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ELECTRIC FIELD IN THE VICINITY OF A PHOTOEMITTING PLATE IN A PLASMA **c25**
J. Barengoltz and C. Bauerle *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 26-32 refs (For availability see N73-32836 23-34)

CSCL 20I

Knowledge of the electric field in the vicinity of a spacecraft provides necessary corrections to measurements of ambient fields and charged particle fluxes and a required parameter to understand the motion of dust particles and grains around the spacecraft. The complex problem of the entire electric field, needed for grain transport calculations, is treated for the one-dimensional case. By approximations to the analysis of a photo-emitting plate immersed in a dilute plasma, explicit expressions for the potential and the electric field were derived. The two classes of implicit solutions for the potential reported by them are shown to yield essentially identical results for the conditions in our solar system. The values were obtained following assumptions of a later paper by Guernsey and Fu, in which the emitted photoelectron distribution is taken as Maxwellian. These results are compared with a simple model due to Grand and Tunaley, wherein the effect of the dilute plasma is neglected entirely. Author

N73-32840* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

STUDY OF INTERACTION AMONG SILICON, LITHIUM, OXYGEN AND RADIATION-INDUCED DEFECTS FOR RADIATION-HARDENED SOLAR CELLS c03

P. A. Berman *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 33-44 refs (For availability see N73-32836 23-34)

CSCL 10A

In order to improve reliability and the useful lifetime of solar cell arrays for space use, a program was undertaken to develop radiation-hardened lithium-doped silicon solar cells. These cells were shown to be significantly more resistant to degradation by ionized particles than the presently used n-p nonlithium-doped silicon solar cells. The results of various analyses performed to develop a more complete understanding of the physics of the interaction among lithium, silicon, oxygen, and radiation-induced defects are presented. A discussion is given of those portions of the previous model of radiation damage annealing which were found to be in error and those portions which were upheld by these extensive investigations. Author

N73-32841* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A METHOD FOR ESTIMATING BOTH THE SOLUBILITY PARAMETERS AND MOLAR VOLUMES OF LIQUIDS c06

R. F. Fedors *In its* JPL Quart. Tech. Rev., Vol. 3, No. 1 Apr. 1973 p 45-53 refs (For availability see N73-32836 23-34)

CSCL 07D

A method, based on additive constants, is proposed for estimating the solubility parameters, molar volume, and thermodynamic properties of liquids. E.H.W.

N73-32842*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

STUDIES IN SHORT HAUL AIR TRANSPORTATION IN THE CALIFORNIA CORRIDOR: EFFECTS OF DESIGN RUNWAY LENGTH; COMMUNITY ACCEPTANCE; IMPACT OF RETURN ON INVESTMENT AND FUEL COST INCREASES, VOLUME 1

Richard S. Shevell and David W. Jones, Jr. Jul. 1973 207 p refs 2 Vol.

(Contract NAS2-7199)

(NASA-CR-114634; SUDAAR-460-Vol-1) Avail: NTIS HC $12.50 CSCL 01E

The impact of design runway length on the economics and traffic demand of a 1985 short haul air transportation system in the California Corridor was investigated. The community acceptance of new commercial airports for short haul service was studied. The following subjects were analyzed: (1) travel demand, (2) vehicle technology, (3) infrastructure, (4) systems analysis, and (5) effects on the community. The operation of the short haul system is compared with conventional airline operations. Author

N73-32843*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

STUDIES IN SHORT HAUL AIR TRANSPORTATION IN THE CALIFORNIA CORRIDOR: EFFECTS OF DESIGN RUNWAY LENGTH; COMMUNITY ACCEPTANCE; IMPACT OF RETURN ON INVESTMENT AND FUEL COST INCREASES. VOLUME 2: APPENDICES

Richard S. Shevell and David W. Jones, Jr. Jul. 1973 194 p refs 2 Vol.

(Contract NAS2-7199)

(NASA-CR-114634(1); SUDAAR-460-Vol-2-App) Avail: NTIS HC $11.75 CSCL 01E

The development of a forecast model for short haul air transportation systems in the California Corridor is discussed. The factors which determine the level of air traffic demand are identified. A forecast equation for use in airport utilization analysis is developed. A mathematical model is submitted to show the relationship between population, employment, and income for indicating future air transportation utilization. Diagrams and tables of data are included to support the conclusions reached regarding air transportation economic factors. Author

N73-32844# Indian Inst. of Tech., Madras.

[ENGINEERING, CHEMICAL, AND SOCIAL SCIENCE RESEARCH] Annual Research Report, 1971 - 1972

1972 278 p refs

Avail: NTIS HC $16.00

Various research activities are reported in the fields of: Aeronautical engineering, applied mechanics, chemical engineering, chemistry, civil engineering, electrical engineering, humanities and social sciences, mathematics, mechanical engineering, metallurgy, and physics. G.G.

N73-32845# Defence Research Analysis Establishment, Ottawa (Ontario).

CANADIAN FORCES EDUCATION AS A CONTRIBUTOR TO NATIONAL DEVELOPMENT

B. G. McRoberts Jun. 1973 55 p refs

(DRAE-37) Avail: NTIS HC $4.75

The education and training provided by the Canadian Armed Forces is analyzed in consideration of its contribution to both the economic and social aspects of national development. From this analysis it appears that the Armed Forces' extensive formally organized education and training program has an important impact on economic development when qualified military personnel are released into the civilian labor market at an early retirement age. In addition, the informal exchange of knowledge between military personnel and other Canadians, as well as programs such as those for the reserves, summer students, cadets, and professorships of military and strategic studies expand education in areas that contribute to social development. Author

N73-32846*# Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.

A STUDY OF THE POTENTIAL OF REMOTE SENSORS IN URBAN TRANSPORTATION PLANNING

Dietmar Rietschier and David G. Modlin, Jr. Jun. 1973 172 p refs

(Contract NAS8-29012)

(NASA-CR-124433) Avail: NTIS HC $10.75 CSCL 05A

The potential uses of remotely sensed data as applied to the transportation planning process are presented. By utilizing the remote sensing technology developed by the National Aeronautics and Space Administration in th various space programs, it is hoped that both the expense and errors inherent in the conventional data collection techniques can be avoided. Additional bonuses derived from the use of remotely sensed data are those of the permanent record nature of the data and the traffic engineering data simulateously made available. The major mathematical modeling phases and the role remotely sensed data might play in replacing conventionally collected data are discussed. Typical surveys undertaken in the overall planning process determine the nature and extent of travel desires, land uses, transportation facilities and socio-economic characteristics. Except for the socio-economic data, data collected in the other surveys mentioned can be taken from photographs in sufficient detail to be useful in the modeling procedures. Author

N73-32847*# Denver Research Inst., Colo. Industrial Economics Div.

PROGRAM FOR TRANSFER RESEARCH AND IMPACT STUDIES Semiannual Report, 1 Jul. - 31 Dec. 1972

Jerome J. Rusnak, James E. Freeman, Joanne M. Hartley, James

P. Kottenstette, and Eileen R. Staskin Jul. 1973 27 p refs (Contract NASw-2362)
(NASA-CR-135720) Avail: NTIS HC $3.50 CSCL 05A

Research activities conducted under the Program for Transfer Research and Impact Studies (TRIS) during 1972 included: (1) preparation of 10,196 TSP requests for TRIS application analysis; (2) interviews with over 500 individuals concerning the technical, economic, and social impacts of NASA-generated technology; (3) preparation of 38 new technology transfer example files and 101 new transfer cases; and (4) maintenance of a technology transfer library containing more than 2,900 titles. Six different modes of technology utilization are used to illustrate the pervasiveness of the transfer and diffusion of aerospace innovations. These modes also provide a basis for distinguishing the unique characteristics of the NASA Technology Utilization Program. An examination is reported of the ways in which NASA-generated technology is contributing to beneficial social change in five major areas of human concern: health, environement, safety, transportation, and communication. Author

N73-32848*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
PROCEEDINGS OF THE NASA/MIT WORKSHOP ON AIRLINE SYSTEMS ANALYSIS, VOLUME 1
Joseph F. Vittek, ed. Jul. 1972 744 p refs Workshop held at Waterville Valley, New Hampshire, 10-21 Jul. 1972 2 Vol. (Contract NASw-2412)
(NASA-CR-135634; FTL-R72-7-Vol-1) Avail: NTIS HC $39.25 CSCL 05C

Economic principles, financial aspects, forecast and demand, and marketing in the development of an air transport industry are considered. For individual titles, see N73-32849 through N73-32874.

N73-32849* Massachusetts Inst. of Tech., Cambridge.
DEVELOPMENT OF THE AIR TRANSPORT INDUSTRY
Nawal Taneja *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 p 1-44 refs (For availability see N73-32848 23-34)
CSCL 05C

The major developments are outlined in the U.S. scheduled air transport industry both domestic and international, together with a brief history of the European air transport system. The role and formulation of the U.S. Civil Aeronautics Board, International Civil Aviation Organization, and International Air Transport Association are also covered. Author

N73-32850* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE ROLE OF THE FEDERAL GOVERNMENT IN THE DEVELOPMENT OF THE US AIR TRANSPORTATION SYSTEM
Joseph F. Vittek *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 27 p (For availability see N73-32848 23-34)
CSCL 05A

Reviewed are the roles of the various Federal agencies in the regulation, control, and development of the Air System, with major emphasis on the Department of Transportation (Office of the Secretary, Federal Aviation Administration, and National Transportation Safety Board) and the Civil Aeronautics Board. Author

N73-32851* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
AN ANALYSIS OF AIRLINE COSTS. LECTURE NOTES FOR MIT COURSES. THE 16.73 AIRLINE MANAGEMENT AND MARKETING
Robert W. Simpson *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 43 p refs (For availability see N73-32848 23-34)
CSCL 05A

The cost analyst must understand the operations of the airline and how the activities of the airline are measured, as well as how the costs are incurred and recorded. The data source is usually a cost accounting process. This provides data on the cumulated expenses in various categories over a time period like a quarter, or year, and must be correlated by the analyst with cumulated measures of airline activity which seem to be causing this expense. Author

N73-32852* Massachusetts Inst. of Tech., Cambridge.
THE ATA-67 FORMULA FOR DIRECT OPERATING COST
Henry B. Faulkner *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 18 p refs (For availability see N73-32848 23-34)
CSCL 05C

The ATA formulas for direct operating cost were developed for the purpose of comparing different aircraft, existing or not, on the same route or the same aircraft on different routes. Such characteristics of the airline as crew pay, maintenance procedures, and depreciation schedules are kept constant. In air transportation systems analysis the 1967 ATA formula is usually used with appropriate exceptions or modifications, such as: different maintenance labor rate, total maintenance multiplied by a factor, maintenance burden deleted, different depreciation schedule, or different spares percentages. Author

N73-32853* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
TECHNOLOGY FOR DESIGN OF TRANSPORT AIRCRAFT. LECTURE NOTES FOR MIT COURSES: SEMINAR 1.61 FRESHMAN SEMINAR IN AIR TRANSPORTATION AND GRADUATE COURSE 1.201, TRANSPORTATION SYSTEMS ANALYSIS **c02**
Robert W. Simpson *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 50 p (For availability see N73-32848 23-34)
CSCL 01C

The design parameters which determine cruise performance for a conventional subsonic jet transport are discussed. It is assumed that the aircraft burns climb fuel to reach cruising altitude and that aeronautical technology determines the ability to carry a given payload at cruising altitude. It is shown that different sizes of transport aircraft are needed to provide the cost optimal vehicle for different given payload-range objectives. G.G.

N73-32854* Harvard Univ., Cambridge, Mass. Dept. of Economics.
BASIC ECONOMIC PRINCIPLES
T. Nicholaus Tideman *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 7 p refs (For availability see N73-32848 23-34)
CSCL 05C

An economic approach to design efficient transportation systems involves maximizing an objective function that reflects both goals and costs. A demand curve can be derived by finding the quantities of a good that solve the maximization problem as one varies the price of that commodity, holding income and the prices of all other goods constant. A supply curve is derived by applying the idea of profit maximization of firms. The production function determines the relationship between input and output. G.G.

N73-32855* Massachusetts Inst. of Tech., Cambridge.
BASIC TRANSPORTATION ECONOMICS
James T. Kneafsey *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 18 p refs (For availability see N73-32848 23-34)
CSCL 05C

Transportation economics is an integral part of all transportation activities. Refined, detailed, and careful economic analyses consider conduct-performance methodology and the specifications of production, cost and demand functions. Author

N73-32856* Texas A&M Univ., College Station.
DETERMINATION OF FARES: PRICING THEORY AND ECONOMIC EFFICIENCY
James C. Miller, III *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 30 p refs (For availability see N73-32848 23-34)
CSCL 05C

The concept of economic efficiency is described, its application to the pricing of air transport services, and its relevance as a policy objective are outlined. The first two sections discuss

economic efficiency in general terms, whereas the third applies this norm to several airline pricing problems. The final section emphasizes the importance of industry behavior as a parameter in policy analysis. Author

N73-32857* United Air Lines, Inc., Chicago, Ill.
DIFFERENTIAL PRICING POLICY
J. B. Gebhardt *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 15 p (For availability see N73-32848 23-34)
CSCL 05C

Differential pricing is a valid means of improving profits, keeping the total cost of air transportation down, and making it possible for more people to use air transportation. Author

N73-32858* United Air Lines, Inc., Chicago, Ill.
THE ECONOMIC EFFECT OF COMPETITION IN THE AIR TRANSPORTATION INDUSTRY
Herbert B. Hubbard *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 25 p (For availability see N73-32848 23-34)
CSCL 05C

The air transportation industry has been described as a highly-competitive, regulated oligopoly or as a price-regulated cartel with blocked entry, resulting in excessive service and low load factors. The current structure of the industry has been strongly influenced by the hypotheses that increased levels of competition are desirable per se, and that more competing carriers can be economically supported in larger markets, in longer haul markets, with lower unit costs, and with higher fare levels. An elementary application of competition/game theory casts doubt on the validity of these hypotheses, but rather emphasizes the critical importance of the short-term non-variable costs in determining economic levels of competition. Author

N73-32859* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
BASIC FINANCE
Joseph F. Vittek *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 66 p (For availability see N73-32848 23-34)
CSCL 05C

A discussion of the basic measures of corporate financial strength, and the sources of the information is reported. Considered are: balance sheet, income statement, funds and cash flow, and financial ratios. Author

N73-32860* Air Transport Association of America, Washington, D.C.
CAPITAL REQUIREMENTS FOR THE AIR TRANSPORT INDUSTRY
George W. James *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 13 p (For availability see N73-32848 23-34)
CSCL 05C

In recent years the U.S. scheduled airline industry has been involved in the largest re-equipment program that involves the addition of hundreds of new aircraft to the airline fleet. The costs associated with the purchase of this new equipment, along with the other costs involving such matters as the environment and security, are presenting the carriers with significant financial challenges. Author

N73-32861* American Airlines, Inc., New York.
FINANCING THE AIR TRANSPORTATION INDUSTRY
D. J. Lloyd-Jones *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 50 p (For availability see N73-32848 23-34)
CSCL 05C

The basic characteristics of the air transportation industry are outlined and it is shown how they affect financing requirements and patterns of production. The choice of financial timing is imperative in order to get the best interest rates available and to insure a fair return to investors. The fact that the industry cannot store its products has a fairly major effect on the amount of equipment to purchase, the amount of capital investment required, and the amount of return required to offset industry depriciation. G.G.

N73-32862* Export-Import Bank, Washington, D.C.
THE ROLE OF THE EXPORT-IMPORT BANK IN DEVELOPING THE EXPORT POTENTIAL OF AIRCRAFT SALES
Chosei Kuge *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 1972 11 p (For availability see N73-32848 23-34)
CSCL 05C

A description of the current patterns, terms, and conditions of Eximbank commercial jet aircraft export financing is given. Some discussion of the factors affecting export financing will be noted. Author

N73-32863* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE MARKET DEMAND FOR AIR TRANSPORTATION
Nawal Taneja *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 65 p refs (For availability see N73-32848 23-34)
CSCL 05C

Although the presentation will touch upon the areas of market for air transportation, the theoretical foundations of the demand function, the demand models, and model selection and evaluation, the emphasis of the presentation will be on a qualitative description of the factors affecting the demand for air transportation. The presentation will rely heavily on the results of market surveys carried out by the Port of New York Authority, the University of Michigan, and Census of Transportation. Author

N73-32864* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
TECHNIQUES FOR FORECASTING AIR PASSENGER TRAFFIC
Nawal Taneja *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 16 p refs (For availability see N73-32848 23-34)
CSCL 05A

The basic techniques of forecasting the air passenger traffic are outlined. These techniques can be broadly classified into four categories: judgmental, time-series analysis, market analysis and analytical. The differences between these methods exist, in part, due to the degree of formalization of the forecasting procedure. Emphasis is placed on describing the analytical method. Author

N73-32865* International Civil Aviation Organization, Montreal (Quebec).
AVIATION FORECASTING IN ICAO
James McMahon *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 20 p (For availability see N73-32848 23-34)
CSCL 05A

Opinions or plans of qualified experts in the field are used for forecasting future requirements for air navigational facilities and services of international civil aviation. ICAO periodically collects information from Stators and operates on anticipated future operations, consolidates this information, and forecasts the future level of activity at different airports. Author

N73-32866* American Airlines, Inc., New York.
AMERICAN AIRLINES PROPELLER STOL TRANSPORT ECONOMIC RISK ANALYSIS
Bob Ransone *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 27 p (For availability see N73-32848 23-34)
CSCL 05C

A Monte Carlo risk analysis on the economics of STOL transports in air passenger traffic established the probability of making the expected internal rate of financial return, or better, in a hypothetical regular Washington/New York intercity operation. G.G.

N73-32867* Boeing Computer Services, Inc., Seattle, Wash. Operations Research/Management Sciences.
TRANSPORTATION SYSTEMS EVALUATION
Michael L. Fanning and Richard A. Michelson *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 26 p (For availability see N73-32848 23-34)
CSCL 05A

A methodology for the analysis of transportation systems consisting of five major interacting elements is reported. The analysis begins with the causes of travel demand: geographic, economic, and demographic characteristics as well as attitudes toward travel. Through the analysis, the interaction of these factors with the physical and economic characteristics of the transportation system is determined. The result is an evaluation of the system from the point of view of both passenger and operator. The methodology is applicable to the intraurban transit systems as well as major airlines. Applications of the technique to analysis of a PRT system and a study of intraurban air travel are given. In the discussion several unique models or techniques are mentioned: i.e., passenger preference modeling, an integrated intraurban transit model, and a series of models to perform airline analysis. Author

N73-32868* Lockheed-California Co., Burbank.
WORLD AIR TRAVEL DEMAND, 1950-1980
George N. Sarames *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 36 p (For availability see N73-32848 23-34)
CSCL 05A

Total world scheduled air passenger traffic carried by the airlines of the International Civil Aviation Organization (ICAO), excluding the U.S.S.R., increased from 17.4 billion passenger miles in 1950 to 237.4 billion in 1970. This represents an average annual growth rate of 14% during the past two decades. The U.S.S.R. became a member of ICAO in 1970, and Aeroflot - the only Russian airline - reported 49 billion passenger miles for 1970. This traffic, which encompasses both domestic and international travel as well as some nonscheduled flights, is not included in the ICAO world totals shown in this report. Author

N73-32869* Harvard Univ., Cambridge, Mass.
DETERMINANTS OF MARKET STRUCTURE AND THE AIRLINE INDUSTRY
William Raduchel *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 20 p (For availability see N73-32848 23-34)
CSCL 05A

The general economic determinants of market structure are outlined with special reference to the airline industry. Included are the following facets: absolute size of firms; distributions of firms by size; concentration; entry barriers; product and service differentiation; diversification; degrees of competition; vertical integration; market boundaries; and economies of scale. Also examined are the static and dynamic properties of market structure in terms of mergers, government policies, and economic growth conditions. Author

N73-32870* Massachusetts Inst. of Tech., Cambridge.
OBJECTIVES OF THE AIRLINE FIRM: THEORY
James T. Kneafsey *In its* Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 14 p (For availability see N73-32848 23-34)
CSCL 05A

Theoretical models are formulated for airline firm operations that revolve around alternative formulations of managerial goals which these firms are persuing in practice. Consideration is given to the different objective functions which the companies are following in lieu of profit maximization. G.G.

N73-32871* North Carolina Univ., Chapel Hill.
PROBLEMS OF EXCESS CAPACITY
George Douglas *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 15 p (For availability see N73-32848 23-34)
CSCL 05A

The problems of excess capacity in the airline industry are discussed with focus on the following topics: load factors; fair rate of return on investment; service-quality rivalry among airlines; pricing (fare) policies; aircraft production; and the impacts of excess capacity on operating costs. Also included is a discussion of the interrelationships among these topics. Author

N73-32872* Douglas Aircraft Co., Inc., Long Beach, Calif.
THE ROLE OF THE MANUFACTURER IN AIR TRANSPORTATION PLANNING
James MacKenzie *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 40 p (For availability see N73-32848 23-34)
CSCL 05A

The role of the aircraft manufacturer in the airline industry is considered. The process is illustrated by using a fictitious airline as an example--that is, a case study approach with Mid-Coast Airways serving as the example. Both in slide form and with supporting papers, a brief history of the airline, a description of its route structure and a forecast based on econometric analysis are presented. Once the forecast rationale is explained, information outlines the requirements for additional aircraft and the application of new aircraft across the system using alternative fleet plan options. The fleet plan is translated into financial summaries which indicate the relative merit of alternative aircraft types or operating plans. Author

N73-32873* Pan American World Airways, Inc., New York.
CONSUMER MARKETING AND THE AIRLINE INDUSTRY
William R. Roy *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 21 p (For availability see N73-32848 23-34)
CSCL 05A

The fundamentals of consumer marketing as applied to the airline industry are considered. An attempt is made to boil down the mystique and jargon which frequently surround the subject of marketing. Topics covered include: (1) The marketing concept; (2) consumer expectations from airlines; (3) planning of marketing strategy; and (4) the roles of advertising, sales, and middlemen. Author

N73-32874* Pan American World Airways, Inc., New York.
FUTURE DIRECTION IN AIRLINE MARKETING
Dan A. Colussy *In* MIT Proc. of the NASA/MIT Workshop on Airline Systems Analysis, Vol. 1 Jul. 1972 20 p (For availability see N73-32848 23-34)
CSCL 05A

The rapid growth and broadening of the air travel market, coupled with a more sophisticated consumer, will dramatically change airline marketing over the next decade. Discussed is the direction this change is likely to take and its implications for companies within the industry. New conceptualization approaches are required if the full potential of this expanding market is to be fully realized. Marketing strategies are developed that will enable various elements of the travel industry to compete not only against each other but also with other products that are competing for the consumer's discretionary income. Author

N73-32875*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
MIT-NASA WORKSHOP AIRLINE SYSTEMS ANALYSIS, VOLUME 2
Jul. 1972 602 p refs
(Contract NASw-2412)
(NASA-CR-135635; FTL-R72-7-Vol-2) Avail: NTIS HC $32.25 CSCL 05A

The proceedings of a conference on the Air Transport Industry are presented. The subjects discussed are: (1) analysis of airline costs, (2) transportation economics, (3) airline financing, (4) market demand for air transportation, (5) planning, management, and economics of airport operation, (6) air cargo operations, (7) commuter aircraft operations, (8) regulation of air traffic rates, (9) airline merger policies, and (10) international air transportation operations. For individual titles, see N73-32876 through N73-32903.

N73-32876* Massachusetts Inst. of Tech., Cambridge.
CONCENTRATION OF AIRLINE OPERATIONS AT INDIVIDUAL AIRPORTS
W. Gelerman and R. DeNeufville *In its* MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 29 p refs (For availability see N73-32875 23-34)
CSCL 01E

It is shown that it is a natural property of air transportation networks for competitive airlines to concentrate their operations at individual airports serving a given market. This implies that a strategy of developing satellite airports is doomed to failure unless the competitives behavior of the airlines is restricted. The results

are demonstrated by tracing out the implications of observed patterns of traveller behavior as regards choice of carrier on the optimal game strategy for any particular airline. Analytic results for a two airline, two airport situation are extrapolated to the more general case, and specific supportive evidence from current operations are cited. Author

N73-32877* Massachusetts Inst. of Tech., Cambridge.
PLANNING, MANAGEMENT, AND ECONOMICS OF AIRPORT OPERATION
John Wiley *In its* MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 18 p (For availability see N73-32875 23-34)
CSCL 05A

An overview of the role of the airport in the transportation complex and in the community is presented. The establishment of the airport including its requirements in regional planning and the operation of the airport as a social and economic force are discussed. Author

N73-32878* Port of New York Authority, N.Y.
AIRPORT ECONOMICS: MANAGEMENT CONTROL FINANCIAL REPORTING SYSTEMS
Allen Buchbinder *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 16 p (For availability see N73-32875 23-34)
CSCL 05B

The development of management control financial reporting systems for airport operation is discussed. The operation of the system to provide the reports required for determining the specific revenue producing facilities of airports is described. The organization of the cost reporting centers to show the types of information provided by the system is analyzed. Author

N73-32879* Port of New York Authority, N.Y. Aviation Economics Div.
AIR TRAFFIC FORECASTING AT THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY
Johannes G. Augustine *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 23 p refs (For availability see N73-32875 23-34)
CSCL 05A

Procedures for conducting air traffic forecasts with specific application to the Port Authority of New York and New Jersey are discussed. The procedure relates air travel growth to detailed socio-economic and demographic characteristics of the U.S. population rather than to aggregate economic data such as Gross National Product, personal income, and industrial production. Charts are presented to show the relationship between various selected characteristics and the use of air transportation facilities. Author

N73-32880* Massachusetts Port Authority, Boston.
ROUTE AWARD CONSIDERATIONS
Wilson D. Rogers, Jr. *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 22 p (For availability see N73-32875 23-34)
CSCL 05A

The organization, responsibilities, and functions of the Civil Aeronautics Board are discussed. Several examples of decisions made by the Civil Aeronautics Board on the award of specific air routes to competing air lines are presented. The manner in which route proceedings are initiated and examined is explained. Recommendations are made concerning actions which can be taken to improve the services provided to the flying public. Author

N73-32881* Eastern Air Lines, Inc., Miami, Fla. Cargo Sales and Services.
THE ECONOMICS OF AIR CARGO
John W. Kersey *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 14 p (For availability see N73-32875 23-34)
CSCL 05A

The economic factors involved in air cargo operations and air cargo marketing development are discussed. Specific steps which are followed by various airports to reduce operating costs are described. The economics of cargo handling within an airline are analyzed with respect to: (1) paperwork costs, (2) terminal costs, (3) line haul costs, and (4) claims costs. Author

N73-32882* Eastern Air Lines, Inc., Miami, Fla.
AIR CARGO MARKETING DEVELOPMENT
John W. Kersey *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 12 p (For availability see N73-32875 23-34)
CSCL 05A

The factors involved in developing a market for air cargo services are discussed. A comparison is made between the passenger traffic problems and those of cargo traffic. Emphasis is placed on distribution analyses which isolates total distribution cost, including logistical costs such as transportation, inventory, materials handling, packaging, and processing. Specific examples of methods for reducing air cargo costs are presented. Author

N73-32883* Civil Aeronautics Board, Washington, D.C.
CURRENT PROBLEMS AND ISSUES IN AIR FREIGHT RATES
Alfred R. Stout *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 21 p (For availability see N73-32875 23-34)
CSCL 05C

Actions of the Civil Aeronautics Board in determining air freight rates are discussed. The tariff filings by domestic airlines for making basic changes in domestic fares and rates are reported. The roles of the carriers and the Civil Aeronautics Board in establishing freight rates are defined. Specific examples of areas of controversy in establishing freight rates are included. Methods for improving the air cargo and freight rate situation are proposed. Author

N73-32884* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE FUTURE OF THE US DOMESTIC AIR FREIGHT INDUSTRY
Lewis M. Schneider *In its* MIT-NASA Workshop on Airlines Systems Analysis, Vol. 2 Jul. 1972 21 p refs (For availability see N73-32875 23-34)
CSCL 05A

A research project on the future of U.S. domestic air freight operations was conducted. The two main subjects of the project were: (1) during the 1965 to 1969 time period, when the airlines introduced jet freighters into domestic service and air freight traffic growth continued at a high rate, what strategies were employed by management and with what results and (2) what are the opportunities and problems confronting the domestic air freight industry during the 1970 and 1980 time period. The results of the analysis are presented in the form of graphs and tables. Author

N73-32885* Massachusetts Inst. of Tech., Cambridge.
TRENDS IN COMMUTER AIR CARRIER OPERATIONS
William Swan *In its* MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 17 p (For availability see N73-32875 23-34)
CSCL 05B

The market for commuter air service is analyzed. Methods for reducing the costs of short haul air transportation are discussed. The problems facing the operators of short haul air transport services are identified. Proposed changes in commuter air carrier regulation are submitted. Author

N73-32886* Civil Aeronautics Board, Washington, D.C.
SERVICE TO SMALL COMMUNITIES
Monte Lazarus *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1973 10 p (For availability see N73-32875 23-34)
CSCL 05A

The problems involved in the operation of low cost local service air carriers are analyzed. Four specific situations which created the operating difficulties of the local air carriers are defined. Proposals of federal and local subsidies for short haul air transportation are presented. Author

N73-32887* Charles River Associates, Inc., Cambridge, Mass.
THE SHORT HAUL AIR TRAVEL MARKET: EVALUATION

OF NEW FORMS OF SERVICE
David A. Couts *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 Jul. 1972 28 p refs (For availability see N73-32875 23-34)
CSCL 05C

Aspects of the demand for air travel and an approach for incorporating them in evaluations of new services are discussed. The approach as described here is being used to evaluate the market for STOL aircraft in the 1980's but it could just as well be used to evaluate the market effects of schedule changes, equipment changes, and new routes, if certain basic data relating these changes to demand are available. A most important change in the market which is likely to take place in the next fifteen years, and which is already underway, is the increasing availability of alternative airports in major cities. Author

N73-32888* George Washington Univ., Washington, D.C.
THIRD LEVEL AIR CARRIER SERVICE
George Eads *In* MIT MIT-NASA Workshop on Airline Systems analysis, Vol. 2 Jul. 1972 28 p (For availability see N73-32875 23-34)
CSCL 05A

A proposed Civil Aviation Board approach to regulating commuter air transportation services is discussed. Operating problems of specific air lines are used as examples. Inadequacies in the present service for short haul commuter air transportation are defined. Methods by which improvements in the commuter air transport service are proposed. Author

N73-32889* .Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE RIGHT TO REGULATE
Joseph F. Vittek *In its* MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 19 Jul. 1972 19 p (For availability see N73-32875 23-34)
CSCL 05A

An introduction to the historical and constitutional framework of industry regulation by local and Federal Governments is presented. Problems of the confiscation of private property without due process, government control and the rights and duties of the regulated industry are discussed. Author

N73-32890* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
BASIC RATE MAKING
Joseph F. Vittek *In its* MIT-NASA Workshop on Airline Systems Analysis, Vol 2 19 Jul. 1972 14 p (For availability see N73-32875 23-34)
CSCL 05A

The manner in which the rates charged by airlines are determined is explained. The topics include: (1) the determination of a fair rate of return, (2) the rate base, (3) allowable expenses, (4) load factors, and (5) seating configurations. Author

N73-32891* Texas A&M Univ., College Station. Dept. of Economics.
A CRITIQUE OF CAB REGULATORY POLICY
James C. Miller, III *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 21 Jul. 1972 31 p refs (For availability see N73-32875 23-34)
CSCL 05A

The regulatory policies of the Civil Aviation Board are discussed. The objectives of the Civil Aviation Board are defined. Specific actions of the Civil Aviation Board with respect to passenger fares, rate levels, and load factors are presented. The decisions on successful and unsuccessful mergers of airlines during the 1938 to 1972 time period are analyzed. Tables of data are presented to show the economic aspects of airline operations during 1955, 1960, and 1970. Author

N73-32892* York Univ., Toronto (Ontario).
SURVIVAL, PROFITS AND RESOURCE UTILIZATION
William Jordan *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 14 Jul. 1972 81 p (For availability see N73-32875 23-34)
CSCL 05C

The intertwining of CAB regulation and airline operations makes it impossible to use operating and financial data from the regulated airlines to determine the extent to which regulation affects costs. The essentially nonregulated, but otherwise, similar, intrastate airlines operating wholly within California (and thus beyond the CAB's jurisdiction) provide a benchmark with which to compare the performance of regulated airlines and thus measure the effects of CAB regulation. This comparison, shows that the nonregulated environment within California has been a much sterner disciplinarian of airline operations than the regulated environment of interstate air transportation. Issues of survival, profits, efficiency, fares, and the impacts of CAB regulation on costs are examined. Author

N73-32893* Harbridge House, Inc., Boston, Mass.
FEDERAL REGULATORY TRENDS AND THE EMERGING PROFILES OF AIR TRANSPORTATION
Charles D. Baker *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 21 Jul. 1972 6 p (For availability see N73-32875 23-34)
CSCL 05A

The economic aspects of Federal regulation of airlines are discussed. The problems involved in obtaining capital resources for airline operations and expansion are analyzed. The functions of various agencies and their impact on the economic status of the airlines are explained. Author

N73-32894* Harvard Univ., Cambridge, Mass. Harvard Business School.
THE FUTURE OF REGULATION IN THE AIRLINE INDUSTRY
Paul W. Cherington and James J. Hill *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 21 Jul. 1972 5 p (For availability see N73-32875 23-34)
CSCL 05A

The Federal regulation of airlines is analyzed to predict the amount of regulation to be expected in the future. It is stated that the regulatory powers will increase because of the advantages that such regulation provides to the airlines. Six propositions are submitted as guidelines for future airlines regulation. The loss of revenue experienced by the airlines is examined and methods for improving the economic situation are defined. Author

N73-32895* Civil Aeronautics Board, Washington, D.C.
MERGERS AND ANTI-TRUST ISSUES IN RECENT CAB CASES
A. M. Andrews *In* MIT MIT-NASA Workshop on Airline System Analysis, Vol. 2 19 Jul. 1972 10 p (For availability see N73-32875 23-34)
CSCL 05A

The airline industry is surveyed-particularly domestic trunk-lines-in relation to collective approaches to industry concerns. These actions are classified by the apparent degree of anti-trust issue present. Recent route merger cases are considered from the CAB staff viewpoint. Author

N73-32896* Department of Transportation, Washington, D.C.
DEPARTMENT OF TRANSPORTATION MERGER POLICY
John Gillick *In* MIT MIT-NASA Workshop Workshop on Airline System Analysis, Vol. 2 19 Jul. 1972 23 p (For availability see N73-32875 23-34)
CSCL 05A

The policy of the Department of Transportation with respect to evaluating airline mergers is discussed. The subjects presented are: (1) statutory responsibilities of the Department of Transportation, (2) interrelationship of airline merger policy and overall airline policy, (3) executive branch criteria for domestic airline merger proposals, and position of Department of Transportation on several merger proceedings. Author

N73-32897* Department of Justice, Washington, D.C.
JUSTICE DEPARTMENT AIRLINE MERGER POLICY
Donald A. Farmer *In* MIT MIT-NASA Workshop on Airline System Analysis, Vol. 2 19 Jul. 1972 20 p refs (For availability see N73-32875 23-34)
CSCL 05A

Justice Department airline merger policy is developed within the context of the Federal Aviation Act, in which there is an unusually explicit reliance on competition as a means of

fulfilling statutory goals. The economics of the airline industry appear to indicate that low concentration and vigorous competition are particularly viable and desirable. Several factors, including existing regulatory policy, create incentives for airlines to merge whether or not an individual merger promotes or conflicts with the public interest. Specific benefits to the public should be identified and shown to clearly outweigh the detriments, including adverse competitive impact, in order for airline mergers to be approved. Author

N73-32898* Allegheny Airlines, Inc., Washington, D.C. Legal Affairs and Marketing Services.
ONE AIRLINE'S VIEW OF MERGERS
Edwin I. Colodny *In* MIT MIT-NASA Workshop on Airline System Analysis, Vol. 2 19 Jul. 1972 14 p (For availability see N73-32875 23-34)
CSCL 05A

Specific cases of airline mergers are discussed to show the legal aspects involved and the procedures followed. The effects of the mergers on the airlines involved are analyzed. The impact of the mergers on management, personnel, and the overall airline operations is reported. Author

N73-32899* Civil Aeronautics Board, Washington, D.C.
INTERNATIONAL AIR TRANSPORT POLICY
Charles Butler *In* MIT MIT-NASA Workshop on Airline System Analysis, Vol. 2 21 Jul. 1972 31 p (For availability see N73-32875 23-34)
CSCL 05A

The actions of the Civil Aviation Board in providing assistance and advice to the State Department regarding international air transport policy are discussed. The policies and guidelines of the Civil Aviation Board are defined. The relationship with the policies of the Executive Branch of the Government and the interpretations of the Department of Transportation are reported. Author

N73-32900* Aerospace Industries Association of America, Inc., Washington, D.C.
COMMERCIAL AIRCRAFT DEVELOPMENT AND THE EXPORT MARKET
Joseph Snodgrass *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 20 Jul. 1972 20 p refs (For availability see N73-32875 23-34)
CSCL 05C

The various factors which endanger the future of commercial aircraft development are defined. The factors discussed are: (1) a decline in federally funded research and development programs, (2) a general decline in the economic health of the domestic airlines, (3) the increased cost of development which may be several times the net worth of the company, (4) the development overseas of common market and manufacturing consortia, and (5) foreign manufacturers receiving significant financial support from their national governments. It is stated that unless immediate and innovative solutions to combat these factors are found, the commercial aviation industry will be in serious difficulty. Author

N73-32901* Trans World Airlines, Inc., New York.
SCHEDULING FOR PUBLIC SERVICE IN INTERNATIONAL OPERATIONS
Melvin A. Brenner *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 18 Jul. 1972 19 p (For availability see N73-32875 23-34)
CSCL 05A

The factors involved in scheduling airline services for international operations are discussed. Charts are presented to show the transatlantic pattern of flights for a typical airline during the summer and winter months. The operations of a domestic airline operating overseas and a foreign airline operating to the United States are compared. Author

N73-32902* Department of Transportation, Washington, D.C.
INTERNATIONAL AIR TRANSPORT AND FEDERAL POLICY
Robert Henri Binder *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 21 Jul. 1972 12 p (For availability see N73-32875 23-34)
CSCL 05A

The Federal policy which establishes guidelines for future U.S. participation in the international air transportation industry is discussed. The policy issues discussed include the following: (1) aircraft hijacking, both foreign and domestic, (2) relationship of scheduled services and charter services, (3) capacity problems, and (4) rate regulation. Author

N73-32903* Air Transport Association of America, Washington, D.C.
UNITED STATES INTERNATIONAL AIR TRANSPORT POLICY, THE PROMISE AND THE REALITY
James E. Landry and Gabriel Phillips *In* MIT MIT-NASA Workshop on Airline Systems Analysis, Vol. 2 21 Jul. 1972 32 p (For availability see N73-32875 23-34)
CSCL 05A

The United States international air transportation policy is discussed. The major departure of the current policy lies in the relationship between scheduled and charter services. Various provisions of the transportation charter are analyzed to show the restrictions as well as the benefits the legislation holds for commercial aviation. It is stated that a group of full service carriers can meet the full spectrum of demands for air transportation more efficiently than two or more groups. Author

N73-32904# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE - SCIENTIFIC AFFAIRS, NO. 356
18 Sep. 1973 23 p Transl. into ENGLISH from Albanian and Romanian Reports
(JPRS-60063) Avail: NTIS HC $3.25

Articles are presented concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences. Author

N73-32905*# Aerospace Corp., El Segundo, Calif. Air Transportation Group.
SYSTEMS EVALUATION OF LOW DENSITY AIR TRANSPORTATION CONCEPTS
R. W. Bruce and H. M. Webb Jul. 1972 96 p refs
(Contract NAS2-6473)
(NASA-CR-114484; ATR-73(9981)-1) Avail: NTIS HC $7.00
CSCL 01E

Methods were studied for improving air transportation to low-density population regions in the U.S. through the application of new aeronautical technology. The low-density air service concepts are developed for selected regions, and critical technologies that presently limit the effective application of low-density air transportation systems are identified. F.O.S.

N73-32906*# Alabama Univ., University.
RESEARCH IN THE AEROSPACE PHYSICAL SCIENCES Final Report, 1 Mar. 1969 - 31 Aug. 1973
Robert N. Whitehurst Sep. 1973 35 p refs
(Grant NGL-01-002-064; NGL-01-002-001; NGR-01-002-002)
(NASA-CR-135697) Avail: NTIS HC $3.75 CSCL 05A

Research efforts are reported in various areas including dynamics of thin films, polymer chemistry, mechanical and chemical properties of materials, radar system engineering, stabilization of lasers, and radiation damage of organic crystals. Brief summaries of research accomplished and literature citations are included. Author

N73-32907# Joint Publications Research Service, Arlington, Va.
ECONOMIC EVALUATION OF AIRCRAFT AND SPACECRAFT
S. A. Sarkisyan and E. S. Minayev 24 Sep. 1973 188 p refs Transl. into ENGLISH from the book "Ekonomicheskaya Otsenka Letatel'nykh Apparatov" Moscow, Izdatel'stvo Mashinostroyeniye, 1972 177 p
(JPRS-60104) Avail: NTIS HC $11.50

The report contains a study of the economic problems of the analysis and selection of optimal versions of complex technical

systems (in the example of systems of aircraft and spacecraft). The characteristics features and significance of technical progress in the aerospace industry are discussed, and problems of systems analysis when forecasting technical progress are analyzed.
Author

N73-32908*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A SELECTIVE LIST OF ACRONYMS AND ABBREVIATIONS
Jul. 1973 205 p refs Revised
(NASA-TM-X-69523; KSC-GP-589-Rev-4) Avail: NTIS HC $12.25 CSCL 05B

A glossary of acronyms, abbreviations, initials, code words, and phrases used at the John F. Kennedy Space Center is presented. The revision contains more than 12,100 entries.
Author

N73-32909*# Washington Univ., St. Louis, Mo. Center for Development Technology.
A DELPHI FORECAST OF TECHNOLOGY IN EDUCATION
Burke E. Robinson Aug. 1973 139 p refs
(Grant NGR-26-008-054)
(NASA-CR-135477; Rept-(R)T-73/1) Avail: NTIS HC $9.00 CSCL 05I

The results are reported of a Delphi forecast of the utilization and social impacts of large-scale educational telecommunications technology. The focus is on both forecasting methodology and educational technology. The various methods of forecasting used by futurists are analyzed from the perspective of the most appropriate method for a prognosticator of educational technology, and review and critical analysis are presented of previous forecasts and studies. Graphic responses, summarized comments, and a scenario of education in 1990 are presented. F.O.S.

N73-32910*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERACTION OF POLLUTION ABATEMENT WITH WORLD DYNAMICS
G. Louis Smith Washington Oct. 1973 39 p refs
(NASA-TM-X-2832; L-8961) Avail: NTIS HC $3.00 CSCL 06F

The world dynamics model of Jay W. Forrester was modified to account for pollution abatement. In the modified model, it is assumed that as pollution increases, efforts are made to control pollution. There is a competition between food supply, material standard of living, and pollution abatement for capital, and time is required for diversion of capital toward pollution abatement. Inclusion of pollution abatement in the model drastically alters the response of the world system for the case in which depletion of natural resources is not considered. Instead of undergoing a pollution catastrophe, all system levels move more or less smoothly toward an equilibrium. A FORTRAN program listing of the modified world dynamics model is included. Author

N73-32911*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ABSTRACTS OF NASA-ASRDI PUBLICATIONS RELEVANT TO AEROSPACE SAFETY RESEARCH
G. Mandel and P. J. McKenna 1973 35 p refs
(NASA-TM-X-71428) Avail: NTIS HC $3.75 CSCL 05B

Abstracts covering the following areas are presented: (1) oxygen technology; (2) fire safety; (3) accidents/incidents; (4) toxic spills; (5) aircraft safety; (6) structural failures; (7) nuclear systems; (8) fluid flow; and (9) zero gravity combustion. A.L.

N73-32912# Committee on Science and Astronautics (U. S. House).
SKYLAB 1 INVESTIGATION REPORT
Washington GPO 1973 206 p Hearing before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., no. 6, 1 Aug. 1973 Avail: Subcomm. on Manned Space Flight

The launch anomaly summary for Skylab 1 contains principle findings and corrective actions in regard to the solar array system failure to deploy with breakup and loss of the meteoroid shield at about 63 seconds after launch. G.G.

N73-32913*# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
TECHNOLOGY ASSESSMENT: WHAT SHOULD IT BE?
Guy Black Jun. 1971 57 p refs
(Grant NGL-09-010-030)
(NASA-CR-135783; GWPS-SDP-211) Avail: NTIS HC $5.00 CSCL 05B

A report on technology assessment (TA) is presented. Topics discussed include: the nature of TA, TA used as an analytical method for natural and social sciences, and the uncertain consequences of TA. K.M.M.

N73-32914*# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
SOME IMPLICATIONS OF THE TECHNOLOGY ASSESSMENT FUNCTION FOR THE EFFECTIVE PUBLIC DECISION-MAKING PROCESS
Louis H. Mayo May 1971 36 p refs
(Grant NGL-09-010-030)
(NASA-CR-135782; Occasional-Paper-12) Avail: NTIS HC $4.00 CSCL 05A

A preliminary provisional assessment of the prospects for the establishment of an adequate technology assessment function and the implications of the assessment function for the public decision process are presented. Effects of the technology assessment function on each phase of the public decision process and briefly explored. Significant implications during the next decade are projected with respect to the following phases: invention and development of alternative means (technological configurations); evaluation, selection and promotion of preferred courses of action; and modification of statutory scheme or social action program as an outcome of continuing monitoring and appraisal. Author

N73-32915# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
WORK PROGRAM FOR 1973 [PROJET DE PROGRAMME 1973]
Sep. 1972 45 p In FRENCH
(AD-03-72) Avail: NTIS HC $4.25

The 1973 budget forecast for the French Laboratoire d'Astronomie Spatiale (LAS) is presented. Equipment needed for the ATLAS S183 and UVL balloon experiments are discussed. Personnel complements and expenses, mission costs, equipment costs, running expenses, and the LAS organigram are detailed.
ESRO

N73-32916# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, MAY 1973
Stuart G. Hibben 16 Jul. 1973 145 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-763742; AFOSR-73-1212TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on contractural subjects that were completed in April 1973. The major topics are laser technology, effects of strong explosions, geosciences, particle beams and material sciences. A section on atmospheric physics and one on miscellaneous interest is also included. Laser coverage is generally limited to high power effects. All current laser material is routinely entered in the quarterly laser bibliographies. An index identifying source abbreviations and a first-author index to the abstracts are appended. GRA

N73-32917# Army Foreign Science and Technology Center, Charlottesville, Va.
TECHNOLOGY AND ARMAMENT. NO. 1, JANUARY 1973
27 Jun. 1973 174 p refs Transl. into ENGLISH of Tekhn. i Vooruzhenie (Moscow), no. 1, 1973
(AD-763323; FSTC-HT-23-1864-73) Avail: NTIS CSCL 15/3

Articles written by Russian officer personnel and by Russian civilian scientific personnel are mainly on new scientific and technological advances. GRA

N73-32918# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, APRIL 1973
Stuart G. Hibben 25 Jun. 1973 194 p refs

(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-763743; AFOSR-73-1129TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on contractural subjects that were completed in April 1973. The major topics are laser technology, effects of strong explosions, geosciences, particle beams and material sciences. A section on atmospheric physics and one on miscellaneous interest is also included. Laser coverage is generally limited to high power effects. All current laser material is routinely entered in the quarterly laser bibliographies. An index identifying source abbreviations and a first-author index to the abstracts are appended. GRA

N73-32919# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

[RESEARCH ON PLASMA PHYSICS, ELECTRONICS, DATA PROCESSING, RADIO ASTRONOMY, AND NUCLEAR FUSION] Quarterly Progress Report No. 110

H. J. Zimmerman, G. G. Harvey, and S. J. Mason 15 Jul. 1973 208 p refs
(Contract DAAB07-71-C-0300)
(AD-765002; QPR-110) Avail: NTIS CSCL 05/2

The document contains reports on molecular beams, radio astronomy, electrodynamics of media, plasmas and controlled nuclear fusion, gaseous electronics, applied plasma research, processing and transmission of information, speech communication, linguistics, communications biophysics, neurophysiology, and signal processing. GRA

N73-32920# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

VULNERABILITY OF DRY BAYS ADJACENT TO FUEL TANKS UNDER HORIZONTAL GUNFIRE Technical Report, Mar. 1966 - Jun. 1971

Robert G. Clodfelter Mar. 1973 102 p refs
(AF Proj. 3048)
(AD-764732; AFAPL-TR-72-83) Avail: NTIS CSCL 19/4

The report deals with the relative vulnerability to incendiary action of dry bays adjacent to fuel tanks as a function of fuel type. Cal .50 API horizontal gunfire was the threat; a high level of simulation was achieved by having air flow external to and in the dry bays. The results of a wide range of test conditions are presented. The overall conclusion of the investigation was that JP-8 fuel is less susceptible to fire and explosion induced by gunfire and should produce less aircraft structural damage than JP-4. Author (GRA)

N73-32921# Naval Ordnance Lab., White Oak, Md.

STATIONARY SURFACE TARGET EFFECTIVENESS MODEL

Marvin Kasper and Frank E. Cooke 21 May 1973 98 p refs
(AD-764884; NOLTR-73-109) Avail: NTIS CSCL 15/7

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NEW NASA PUBLICATIONS

Life Beyond Earth and the Mind of Man (NASA SP-328)

Edited by RICHARD BERENDZEN

The proceedings of a symposium sponsored by Boston University and NASA and held in Boston on November 18, 1972. It was a special kind of symposium in which two astronomers, a biologist, a physicist, an anthropologist, and a theologian, all of them men of distinction in their fields, were brought together in an open forum to discuss the possibility that technically advanced civilizations may exist on the planets of distant stars. Panelists were Richard Berendzen, moderator; Ashley Montagu; Philip Morrison; Carl Sagan; Krister Stendahl, and George Wald. *Paperbound.* 116 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.25.

The International System of Units—Physical Constants and Conversion Factors (Second Revision) (NASA SP-7012)

By E. A. MECHTLY

This document, which gives definitions of SI units and tables of numerical factors for converting from miscellaneous units to SI units, has been revised to incorporate resolutions adopted by the Fourteenth General Conference on Weights and Measures held in 1971. *Paperbound.* 28 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $0.50.

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